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Agency

Office Of Water
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Storm Water Discharges Potentially Addressed By Phase II Of The National Pollutant Discharge Elimination System Storm Water Program

Report To Congress

This report has been prepared by the U.S. Environmental Protection Agency, Office of Wastewater Management, Permits Division (4203), 401 M Street, S.W., Washington, D.C. 20460. Inquiries pertaining to this report should be sent to this address or may be made by calling (202) 260-9545. Copies are available from the Office of Water Resource Center, (202) 260-7786.

March 1995

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
WASHINGTON D C 20460

MAR 29 1995

THE ADMINISTRATOR

Honorable Albert Gore, Jr.
President of the Senate
Washington, D.C. 20510

Dear Mr. President:

I am pleased to present the Environmental Protection Agency's (EPA) "Report to Congress on Storm Water Discharges Potentially to be Addressed by Phase II of the National Pollutant Discharge Elimination System Storm Water Program." With this Report as a starting point, I believe, together with Congress and our other partners, we can make substantial progress in utilizing more cost-effective and resourceful ways to control storm water pollution and to protect public health and the environment.

This Report responds to Section 402(p)(5) of the Clean Water Act and provides data, analysis, and recommendations concerning the number and type of discharges potentially to be covered by a phase II storm water program. The Report also identifies the nature and extent of these discharges and discusses one possible approach to implementing a phase II storm water program.

Although this Report discusses only one possible approach for a phase II storm water program, EPA looks forward to working with Congress, States, Tribes, local governments, and other stakeholders to identify other options for a phase II program. Already, EPA is taking steps to explore additional possibilities by developing partnerships and seeking ideas from all groups that will be involved. We will draw on our experience with the phase I storm water program and collaborative efforts with our stakeholders to ensure a cost-effective storm water program.

As a first step, EPA is establishing an urban wet-weather advisory group composed of stakeholders from industry, States, municipalities, commercial and retail establishments, environmental groups and others, to address policy and technical issues related to urban wet weather. A storm water phase II subgroup will be formed to consider cost-effective ways of addressing pollution from phase II storm water discharges. We will share the results of these efforts with Congress as they develop.

In addition to the phase II efforts, we plan to review and streamline the phase I storm water program. We will consider changes to existing monitoring and permitting requirements for regulated phase I municipal dischargers and will resolve questions regarding what cities must do under the Act's storm water control "maximum extent practicable" requirements.

I believe this Report responds fully to the mandates of Section 402(p)(5) of the Clean Water Act, and I hope Congress finds it useful in determining how to proceed with the storm water program.

Sincerely,

Carol M. Browner

Enclosure

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Speaker of the House
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Washington, D.C. 20515

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EXECUTIVE SUMMARY

Introduction

Storm water discharges have been linked to one-third of all assessed surface water quality impairments nationwide by transporting large quantities of pollutants to our Nation's waterways.[1] Significant sources of contaminated storm water include urban runoff, industrial activities, construction, mining, other types of resource extraction, and different commercial activities. To address this problem, Congress amended the Clean Water Act (CWA) in 1987 to establish a phased approach for issuing National Pollutant Discharge Elimination System (NPDES) permits for storm water discharges.

Phase I of the storm water program, now underway, controls storm water discharges only from industrial activity and municipal separate storm sewer systems serving populations greater than 100,000. Many other sources of polluted storm water remain unaddressed. To deal with them, Congress required the United States Environmental Protection Agency (EPA) to prepare a study identifying additional sources of storm water contamination and establishing procedures and methods to control these discharges under a Phase II storm water program.

This report presents the results of the study to identify potential sources for consideration in a Phase II program and a discussion of the nature and extent of pollutants in their discharges. This report also contains recommendations for how to control Phase II storm water sources.

[1] This estimate is based on information contained in EPA's *National Water Quality Inventory, 1992 Report to Congress*, prepared pursuant to the Clean Water Act, Section 305(b), which is based on State reports of assessments of surface water impacts.

The storm water sources identified in this report and the recommendations for controlling these sources, represent one possible approach, developed by EPA, to a Phase II storm water program. Other approaches are also feasible and EPA plans to explore these through a broad inclusionary process with stakeholders from industry, municipalities, commercial and retail establishments, environmental groups and other interested parties. This will be done by establishing a Federal Advisory Committee Act (FACA) subcommittee on Phase II. This subcommittee will be tasked with examining the key issues for a Phase II storm water program and with recommending cost-effective ways of addressing pollution from Phase II sources. The outcome of this effort may be the formulation of a Phase II storm water program that will differ in scope and procedure from the approach discussed in this report.

This report includes an introduction to the study (Chapter 1), a description of the approach used (Chapter 2), an analysis of municipal sources to be included in Phase II (Chapter 3), and a review of individual sources to be addressed in Phase II (Chapter 4), as well as numerous appendices, which provide supporting data and information.

Summary of Key Findings

EPA has identified two major classes of potential Phase II storm water discharges that are described in this report: (1) discharges from municipal separate storm sewer systems not subject to Phase I and (2) discharges from individual (industrial, commercial, and institutional) facilities not subject to Phase I.

Based on the identification and analysis of potential Phase II sources and available information on impacts of storm water discharges, this report recommends that Phase II of the storm water program focus on the 405 urbanized areas identified by the Bureau of the Census. As described in *President's Clinton's Clean Water Initiative*, municipalities in these urbanized areas would be authorized to regulate industrial dischargers and to address, as necessary, commercial, institutional, and retail services within their jurisdiction using a flexible approach rather than EPA or the States permitting these sources directly.

Significant environmental benefit, including reduced pollutant loadings from urbanized areas, will be obtained by extension of the storm water program to these areas. As summarized below and explained in detail in this report, urbanized areas contain a large percentage of population and population growth, as well as industrial, commercial, and retail facilities, while constituting only 2 percent of the total land area. Focusing Phase II of the storm water program on urbanized areas thus targets the highest concentration of pollutant sources and maximizes the potential benefits.

Background

Water Quality Impacts

While rainfall and snow are natural events, the nature of runoff and its impact on water resources are highly dependent on human activities and the use of the land. Storm water runoff can affect surface water quality in two basic ways: (1) natural flow patterns can be radically altered; and (2) pollution concentrations and loadings can be highly elevated.

The National Water Quality Inventory, a report prepared every 2 years summarizing biennial State reports required by Section 305(b) of the CWA, provides a national assessment of surface water impacts associated with runoff from various land uses. The most recent report in this series, *The National Water Quality Inventory, 1992 Report to Congress,* concludes that storm water runoff from a number of diffuse sources, including agricultural areas, municipal separate storm sewers, urban runoff, and atmospheric deposition, are the leading cause of surface water quality impairment cited by States. Five leading contributors to use impairment are shown in Table ES-1.

Storm water runoff from urbanized areas and industrial and commercial activities can contain high levels of contaminants, such as sediment, suspended solids, nutrients, heavy metals, pathogens, toxics, oxygen-demanding substances, and floatables.[2] In urban areas,

[2] National Water Quality Inventory: *1992 Report to Congress*, EPA, 1994.

Table ES-1. Five Leading Sources of Water Quality Impairment for Selected Classes of Waters

Rank	Rivers	Lakes	Estuaries
1	Agriculture	Agriculture	Municipal Point Sources
2	Municipal Point Sources	**Urban Runoff / Storm Sewers**	**Urban Runoff / Storm Sewers**
3	**Urban Runoff / Storm Sewers**	Hydrologic / Habitat Modification	Agriculture
4	Resource Extraction	Municipal Point Sources	Industrial Point Sources
5	Industrial Point Sources	Onsite Wastewater Disposal	Contaminated Sediments

Source: *National Water Quality Inventory, 1992 Report to Congress*, EPA, 1994.

the cumulative effect of widespread development will also change natural drainage patterns, causing much higher wet-weather peak flows and reduced dry-weather base flows in urban streams and wetlands. Increased peak flows can cause severe hydromodifications such as stream bank erosion, streambed scour, flooding, channelization, and alteration and/or elimination of habitat.[3] These flows will also accumulate and transport pollutants to receiving waters. These pollutants are generated from the numerous human activities within the urban area. Industrial and commercial operations, which are generally located in urban areas, can be significant sources of storm water contamination because of the nature of activities conducted, and materials stored, outdoors.

Appendix B provides an overview of the impacts associated with different pollutant classes and types of receiving waters and ground water. Pollutants associated with widespread urban development are discussed in Chapter 3. Pollutants associated with selected classes of industrial and commercial activities are discussed in Chapter 4.

Clean Water Act Framework

The 1972 amendments to the Federal Water Pollution Control Act (referred to as the Clean Water Act [CWA]) prohibit the discharge of any pollutant to navigable waters from a

[3] *Environmental Impacts of Storm Water Discharges—A National Profile*, EPA, June 1992, EPA 841-R-92-001.

point source unless the discharge is authorized by a National Pollutant Discharge Elimination System (NPDES) permit issued under Section 402. In 1987, Section 402(p) was added to the CWA to modify the framework for addressing point source discharges composed entirely of storm water ("storm water discharges") under the NPDES program,[4] establishing a phased approach for issuing NPDES storm water permits. Phase I of the program addresses storm water from industrial facilities and discharges from municipal separate storm sewer systems serving populations of 100,000 or more. Section 402(p)(5) of the CWA directs EPA, in consultation with the States, to study additional storm water discharges not addressed by Phase I. Sections 402(p)(5)(A) and (B) direct EPA, in consultation with the States, to:

- Identify those storm water discharges or classes of storm water discharges for which National Pollutant Discharge Elimination System (NPDES) permits are not required under Phase I of the NPDES storm water program
- Determine, to the maximum extent practicable, the nature and extent of pollutants in such discharges.

Section 402(p)(5)(C) of the CWA requires EPA to establish procedures and methods to control Phase II storm water discharges necessary to mitigate impacts on water quality. Recommendations for procedures and methods to control Phase II storm water discharges are summarized in this report and described in detail in *President Clinton's Clean Water Initiative*, which is found in Appendix L. Together, this report, and *President Clinton's Clean Water Initiative*, fulfill the requirements of Section 402(P)(5) of the CWA.

Section 402(p)(6) of the CWA requires EPA, in consultation with State and local officials, to issue regulations for controlling designated Phase II storm water discharges necessary to protect water quality. The regulations must, at a minimum, establish priorities, requirements for State storm water management programs, and expeditious deadlines. The

[4] Storm water is defined in the NPDES regulations as "storm water runoff, snow melt runoff, and surface runoff and drainage." (40 *CFR* 122.26(b)(13))

program may include performance standards, guidelines, guidance, management practices, and treatment requirements, as appropriate.

Findings

Municipal Separate Storm Sewer Systems

The Bureau of the Census estimates that the population of the United States and associated territories was more than 252.2 million in 1990[5]. The concept of urbanized areas as defined by the Bureau of the Census served as an important tool for analyzing potential approaches to a Phase II program that addresses municipal separate storm sewer systems. More than 160 million people (63 percent of the total U.S. population) reside in the 405 urbanized areas, each with a population of 50,000 or more. The Bureau of the Census has defined an urbanized area as a central city (or cities) surrounded by a densely settled area. To meet the Bureau of the Census definition, the population of the entire urbanized area must be greater than 50,000 persons and the closely settled area outside of the city, the urban fringe, must have a population density generally greater than 1,000 persons per square mile (just over 1.5 persons per acre). These areas occupy less than 2 percent of the Nation's total land area and represent the largest, most widespread areas of dense urban development in the country.

The majority of new urban development also occurs in these urbanized areas. Construction activity related to new development is recognized as a significant source of pollution and impairment of waterbodies, providing some of the best opportunities for implementing storm water management controls in a highly cost-effective fashion. Between 1980 and 1990, the population of urbanized areas increased by 21.2 million.[6] Statistics on

[5] Population estimates based on the 50 States, the District of Columbia, Guam, the Commonwealth of Puerto Rico, the Virgin Islands, American Samoa, and the Commonwealth of the Northern Mariana Islands.

[6] About 7 percent of this increase, (1.5 million people) are associated with the net addition of 30 new urbanized areas between 1980 and 1990.

the population, number of urbanized areas, and estimated pollutant loads in runoff in urbanized areas are summarized in Table ES-2 and discussed below.

Phase I of the NPDES program for storm water discharges addresses 81.7 million people in portions of 136 urbanized areas.[7] EPA estimates that about 40 percent of the pollutant loads in storm water discharged from urbanized areas come from Phase I municipalities.

The portions of these 136 urbanized areas that are not addressed by Phase I had a combined population of 35.8 million people in 1990. EPA estimates that 28 percent of the pollutant loads in storm water discharged from urbanized areas come from these Phase II portions of the 136 urbanized areas with a Phase I municipality.

Of the Census-designated urbanized areas, 269 do not have any municipalities subject to Phase I of the storm water program. EPA estimates that 32 percent of the pollutant loads in storm water discharged from urbanized areas come from these 269 urbanized areas.

In addition to populations within urbanized areas discussed above, the Bureau of the Census has identified an additional urban population of 29 million people that live outside urbanized areas, as well as 62.8 million people classified as rural. Although discharges from municipal separate storm sewers serving these populations are potential Phase II sources, they are not addressed in detail in this report.

Individual Phase II Facilities

The findings of this report are summarized in terms of the identification, nature, and extent of unregulated individual facilities. Due to very limited national data on which to base

[7] There are 621 incorporated places (cities) and portions of 77 counties within these 136 urbanized areas. Of these municipalities, 140 cities and 45 counties are specifically identified in the NPDES regulations that were published in November 1990. EPA and authorized NPDES States have designated an additional 481 cities and 32 counties as Phase I municipalities. In addition, approximately 30 municipalities (located in 21 urbanized areas) have received combined sewer exclusions where the total population served by separate storm sewers is less than 100,000 after subtracting the population served by combined sewers. The methodology used to classify municipalities as Phase I vs. Phase II for the purposes of this report is discussed in Chapter 2.

Table ES-2. Estimated Pollutant Loadings From Urban Runoff

Classification	Population Category	Number of Urbanized Areas*	Population* (millions)	Percentage of Urbanized Area Loading
NATIONAL		405	252.2	NA
ALL URBANIZED AREAS	50,000 - 99,999	176	12.2	12
	100,000 -249,999	125	19.5	16
	Over 250,000	104	128.7	72
	TOTAL	405	160.4	100
URBANIZED AREAS AFFILIATED WITH PHASE I MUNICIPAL SEPARATE STORM SEWER SYSTEMS (MS4)				
– Phase I MS4s within Phase I affiliated Urbanized Areas	50,000 - 99,999	8	0.4	0
	100,000 - 249,999	47	6.3	5
	Over 250,000	81	75.0	35
	SUBTOTAL	136	81.7	40
– Phase II Portions of Phase I affiliated Urbanized Areas	50,000 - 99,999	8	0.2	1
	100,000 - 249,999	47	1.9	2
	Over 250,000	81	33.7	25
	SUBTOTAL	136	35.8	28
	TOTAL	136	117.5	68
URBANIZED AREAS NOT AFFILIATED WITH A PHASE I MS4				
– Urbanized Areas Not Affiliated with Phase I MS4s	50,000 - 99,999	168	11.6	11
	100,000 -249,999	78	11.3	9
	Over 250,000	23	20.0	12
	TOTAL	269	42.9	32
– Urbanized Areas Containing a City with a CSO Exemption**	50,000 - 99,999	0	0	0
	100,000 -249,999	7	1.5	1
	Over 250,000	14	16.0	9
	TOTAL	21	17.5	10
PHASE I MS4s OUTSIDE URBANIZED AREAS		NA	4.3	NA

* Totals are based upon 1990 Census, and include Puerto Rico, Guam, Virgin Islands, American Samoa, and the Commonwealth of the Northern Mariana Islands.

** Some municipalities identified in the November 1990 application regulations (55 *FR* 47990) as Phase I based on 1980 census data received combined sewer exclusions from Phase I where the total population served by separate storm sewers was less than 100,000 after subtracting the population served by combined sewers. (The 21 urbanized areas [with a population of 17.5 million] containing these municipalities are also contained in the above totals and are not in addition to those totals.)

loadings estimates, the discussion of the extent of unregulated storm water discharges is limited to an analysis of the number and geographic distribution of the potential Phase II facilities. In general, the distribution of these facilities follows the distribution of population with a large percentage of facilities concentrated within urbanized areas.

EPA's efforts to identify sources and categories of storm water discharges for Phase II of the storm water program started with an examination of approximately 7.7 million commercial, retail, industrial, and institutional facilities for which permits are not required in Phase I. This examination resulted in the identification of two general classes of facilities with the potential for discharging pollutants to waters of the United States through storm water point sources. The first group (Group A) includes sources that are very similar, or identical, to Phase I activities but that were not included in Phase I due to the specific language of the statute or EPA's regulatory specificity in defining the universe of Phase I industrial activities. The second general class of facilities (Group B) were identified on the basis of potential activities and pollutants that may contribute to storm water contamination.

EPA estimates that there are approximately 100,000 facilities in Group A. Facilities in this group, which may be of high priority for Phase II due to their similarity to Phase I industrial facilities include: auxiliary facilities or secondary activities (i.e., maintenance of construction equipment and vehicles, local trucking for an unregulated facility such as a grocery store); facilities intentionally omitted from Phase I (i.e., treatment works with a design flow of less than 1 MGD, landfills that have not received industrial waste); and facilities exempted by the Intermodal Surface Transportation Efficiency Act of 1991 (most industrial activities owned or operated by municipalities of less than 100,000 people[8]).

Group B consists of nearly one million facilities. These have been organized into 18 Phase II sectors for the purposes of this report. Of these 18 sectors, the automobile service

[8] The Intermodal Surface Transportation Efficiency Act of 1991 exempted industrial activities owned or operated by municipalities of less than 100,000 population from Phase I permitting requirements with the exception of powerplants, airports, and uncontrolled sanitary landfills.

sector (composed of gas/service stations, general automobile repair, car dealers, new and used, car and truck rental, etc.) makes up more than one-third of the total number of facilities identified in all 18 sectors. The 18 Phase II sectors are listed in Table ES-3.

EPA conducted a geographical analysis of these industrial and commercial facilities. The geographical analysis shows that the majority are located in urbanized areas, as presented in Table ES-3. In general, about 30 percent of potential Phase II facilities are found within the geographic jurisdiction of a Phase I municipality. Including the urbanized areas surrounding these Phase I municipalities adds another 12 to 13 percent of potential Phase II facilities. If all urbanized areas are included, an additional 16 percent of potential Phase II facilities are represented. Thus, nearly twice as many industrial facilities are found in all urbanized areas as are found in Phase I municipalities alone.[9]

President Clinton's Clean Water Initiative

President Clinton's Clean Water Initiative provides recommendations on how best to address the additional storm water sources identified by the study in a Phase II NPDES storm water program. The goal of *President Clinton's Clean Water Initiative* is to ensure that future storm water pollution prevention and management programs are focused where the maximum potential benefits can be obtained for the least cost, as well as to provide additional flexibility. A cost-benefit analysis was prepared for the *President's Initiative* and is summarized in Appendix L. No further cost-benefit analyses were conducted for this report.

The *President's Initiative* recommends that Phase II requirements focus on system-wide permits for municipal separate storm sewer systems in Census-designated urbanized areas. These areas consist of only 2 percent of the total land area, yet contain 63 percent of the

[9] Notable exceptions to this generalization include lawn/garden establishments, small currently unregulated feedlots, wholesale livestock, farm and garden machinery repair, bulk petroleum wholesale, farm supplies, lumber and building materials, agricultural chemical dealers, and petroleum pipelines, which can frequently be associated with smaller municipalities or rural areas.

Table ES-3. Geographic Distribution of Potential Phase II Facilities in Relation to Urbanized Areas

Potential Phase II Facilities Identified		Cumulative % of Facilities Located Within:		
Description	Count	Phase I Areas	Phase I Areas + UAs	All UAs
Phase II - Group A	100,000*	32	45	61
Phase II - Group B	1,015,239	28	40	56
Group B Sectors				
Automotive Service	369,870	27	38	55
Machinery & Electrical Repair	135,744	29	40	56
Intensive Ag. Chemical Use	121,861	26	38	54
Wholesale, Machinery	77,562	32	47	65
Laundries	51,376	38	52	71
Wholesale, Wood Products	48,593	26	36	53
Livestock, Feedlots	43,421**	8	11	20
Petrol. Pipelines & Distributors	35,319	16	25	39
Photographic Activities	30,684	40	53	70
Various Utilities	22,242	24	36	53
Extensive Ag Chem Use	18,992	31	42	62
Transport, Rail and Other	14,808	47	64	81
Wholesale, Metal Products	14,303	36	54	75
Wholesale, Food	11,372	36	49	67
Laboratories	10,683	38	56	74
Muni. Services, Vehicle Maint.	4,611	25	35	51
National Security	2,414	34	43	60
Wholesale, Coal & Ores	1,384	23	31	48

* This figure is an approximation based on the total number of facilities in SIC codes 10 through 45 after subtracting an estimate of the number of facilities covered under Phase I. Geographical distribution information is based on all facilities in SIC codes 10 through 45, and may not be representative of all classes of facilities in this group. For the geographic distribution of specific SIC codes, refer to Appendix G.

** This number is based on SIC codes and does not reflect all feedlots potentially subject to Phase II. The United States Department of Agriculture has estimated that there are approximately 378,000 animal feeding operations between 20 and 1000 animal units. The facilities identified here should be representative of feedlots in general and allow estimation of the distribution of these facilities as a class.

total population. Phase II areas account for nearly 60 percent of the loadings from urbanized areas, one and a half times the loadings from Phase I areas. In addition, 57 percent of the national population growth over the past decade has occurred in Phase II areas, compared to 30 percent in Phase I.

The *President's Initiative* contains flexibility in its recommendation that municipalities be authorized to regulate industrial discharges and to address commercial, institutional, and retail sources as necessary within their jurisdiction. This would allow municipalities to control Phase II sources using a flexible approach which would be less costly than having EPA or States permitting individual Phase II sources directly through individual or general permits. Facilities which could certify that there will be no exposure of contaminant sources to rain water and snow melt could be exempted from the storm water program altogether. This change would release low-risk facilities from NPDES requirements, allowing allocation of resources to more critical areas. This would also effectively create incentives for facilities to eliminate exposure of contaminants to rain and snow.

CHAPTER 1. INTRODUCTION

The 1972 amendments to the Federal Water Pollution Control Act (referred to as the Clean Water Act [CWA]) prohibited the discharge of any pollutant to navigable waters from a point source unless the discharge is authorized by a National Pollutant Discharge Elimination System (NPDES) permit. In 1987, Section 402(p) was added to the CWA to modify the framework for addressing point source discharges of storm water under the NPDES program. This provision established a phased approach for issuing NPDES permits for storm water discharges. Phase I of the program addresses storm water from industrial facilities and discharges from municipal separate storm sewer systems serving a population of 100,000 or more. Section 402(p)(5) of the CWA directs the United States Environmental Protection Agency (EPA), in consultation with the States, to study additional storm water discharges not addressed by Phase I of the program. Section 402(p)(5) requires a study for the purpose of:

(A) Identifying those storm water discharges or classes of discharges for which permits are not already required as part of the first phase of the NPDES storm water program, and

(B) Determining, to the maximum extent practicable, the nature and extent of pollutants in such discharges.

(C) Establishing procedures and methods to control storm water discharges to the extent necessary to mitigate impacts on water quality.

Section 402(p)(6) of the CWA provides for EPA to issue regulations that designate additional storm water discharges to be controlled to protect water quality under Phase II of the program and to establish a comprehensive program to regulate such designated sources. The program shall, at a minimum, establish priorities, requirements for State storm water management programs, and expeditious deadlines. The program may include performance standards, guidelines, guidance, and management practices and treatment requirements, as

appropriate. This report presents the results of the study required under Section 402(p)(5) of the CWA.

1.1 BACKGROUND ON THE STORM WATER PROBLEM

While rainfall and snow are natural events, the nature of runoff and its impact on water resources is highly dependent on human activities and use of land. Runoff from lands modified by human activities can affect surface water resources in two ways: (1) natural flow patterns can be modified; and (2) pollution concentrations and loadings can be elevated.

Prior to development of land, a natural hydraulic cycle exists. Rainfall infiltrates to recharge ground water supplies and surface runoff drains through the natural streams which flow to form a watershed. Natural flow patterns can be modified by activities that make the land surfaces more impervious. Activities that alter the natural vegetation can change the natural infiltration characteristics of a watershed. This is particularly evident where widespread urban development occurs. Urban land use results in the removal of vegetation cover and the building of impervious structures such as roads, parking lots, sidewalks, and buildings. In urban areas, the cumulative effect of widespread development may bring dramatic changes to natural drainage patterns, which can cause much higher wet-weather peak flows and reduced dry-weather base flows in urban streams and wetlands. Increased peak flows can cause hydromodifications such as stream bank erosion, streambed scour, flooding, channelization, and elimination and/or alteration of habitat.[1] Additional hydromodifications result from engineered activities to accommodate higher peak flows, such as channel excavation, lining (retaining walls, rip-rap), realignment, underground culverts, and draining of wetlands.

Increased imperviousness and loss of wetlands and natural flow channels associated with urban development also decreases the amount of rainwater available for ground water

[1] *Environmental Impacts of Storm Water Discharges—A National Profile*, EPA, June 1992, EPA 841-R-92-001.

recharge. Reduced ground water levels lower base flows in streams during dry weather periods, which impairs the aquatic habitat, impairs riparian wetlands, and makes receiving streams more sensitive to other pollutant inputs and sedimentation.

Different activities and land uses can also contribute a wide variety of pollutants to runoff. Appendix B provides an overview of different types of impacts associated with different pollutant classes and types of receiving waters and ground water. Pollutants associated with widespread urban development are discussed in Chapter 3. Pollutants associated with selected classes of industrial and commercial activities are discussed in Chapter 4. Chapter 2 provides a description of the methodology and analysis used to develop Chapters 3 and 4.

1.1.1 National Summary of Impacts

The National Water Quality Inventory, a report prepared every 2 years summarizing biennial State reports, as required by Section 305(b) of the CWA, provides a national assessment of surface water impacts associated with runoff from various land uses. The most recent report in this series, *The National Water Quality Inventory, 1992 Report to Congress* provides a general assessment of water quality based on State reports indicating the portion of the States' waters that have been assessed that are not supporting designated uses. The report identifies the sources of use impairment for those waters (e.g., diffuse sources, point sources, and natural sources). Based on information from 51 States and Territories that reported on sources of pollution, the 1992 report indicates that roughly 40 to 60 percent of assessed rivers, lakes, and estuaries are not supporting the uses for which they are designated. In addition, 98 percent of the Great Lake shorelines assessed and 20 percent of the Ocean Coastal Waters were not fully supporting designated uses.

The National Water Quality Inventory, 1992 Report to Congress concludes that storm water runoff from a number of diffuse sources, including agricultural areas, separate storm sewers, urban runoff, and atmospheric deposition, is the leading cause of water quality

impairment cited by States. Summaries of the major sources contributing to use impairment are provided in Tables 1-1 and 1-2.

The *National Water Quality Inventory* indicates that where impairment occurs, the type of land use (e.g., agriculture, urban, resource extraction) within a watershed is often related to the impairment. Urban land use, while only occupying a small fraction of the total land area of the country,[2] is responsible for a disproportionately high percentage of impairment. Urban land use is expected to be correlated to a number of major sources of impairment identified in the *National Water Quality Inventory*, including municipal point sources, separate storm sewers, urban runoff, combined sewer overflows, and many industrial point sources. At the same time, surface water resources in and near urban populations supply drinking water to 200 million U.S. citizens and provide recreational opportunities for millions more.[3]

The agricultural category listed in the *Inventory* comprises a number of activities, most of which are exempt from the definition of "point source" in Section 502(14) of the CWA which, in part, determines the jurisdiction of the NPDES program. One class of sources related to agriculture that is specifically identified in the statutory definition of point source is concentrated animal feeding operations (CAFOs). As discussed below, EPA has issued regulations to define the scope of the term "concentrated animal feeding operation." Although the contribution of various agricultural activities is difficult to evaluate independently, EPA has estimated that feedlots (which include both CAFOs identified as point sources under the NPDES regulations and other feedlots that are not addressed by the regulatory definition) contribute to 13 percent of impaired river miles, 7 percent of impaired

[2] For example, the 1990 Census indicates that 64 percent of the United States population lives in Census-designated urbanized areas of 50,000 or more. However, these urbanized areas are located on less than 2 percent of the total land area of the country. Other development, including smaller urban populations in areas of 10 acres or more and rural transportation, account for an additional 2 percent of land area. By comparison, agricultural activities, including cropland, pasture land and range land, account for 49 percent of the land in the United States. (See *Summary Report, 1987 National Resources Inventory*, Soil Conservation Service, December 1987).

[3] *President Clinton's Clean Water Initiative*, 1994.

Table 1-1. Major Sources of Water Quality Impairment

	Rivers	Lakes	Estuaries	Great Lake Shorelines	Ocean Coastal Waters
Percent of Waters Assessed	18	46	74	99	6
Percent of Assessed Waters Not Fully Supporting Use	44	57	44	98	20
Percent of Waters Not Fully Supporting Use That is Attributed to Source					
Industrial Point Sources	7		23		29
Municipal Point Sources	15	21	53		
Combined Sewer Overflows				8	59
Separate Storm Sewers/Urban Runoff	11	24	43	11	
Agriculture	72	56	43		
Resource Extraction	11		12		
Hydrologic/Habitat Modification	7	23			
On-Site Wastewater Disposal		16			
Contaminated Sediments				40	25
Land Disposal				31	42
Atmospheric Deposition				50	

Explanation of Pollutant Sources

Industrial Point Sources: Industrial process discharges and cooling water
Municipal Point Sources: Sewage treatment plants, including package plants
Combined Sewer Overflows: Discharges from sewage collection systems of sanitary sewage and runoff
Separate Storm Sewers/Urban Runoff: Discharges from separate storm sewers and other urban runoff
Agriculture: Crop production, pastures, rangeland, feedlots, animal holding/management areas, manure lagoons, aquaculture, and irrigation return flows
Silviculture: Forest management, harvesting, residue maintenance and road construction and maintenance
Resource Extraction: Mining and mine drainage
Hydrologic/Habitat Modification: Channelization, dredging, dam construction, flow regulation, bridge construction, streambank modification/destabilization, drainage/filling of wetlands
Land Disposal: Sludge, wastewater, landfills, industrial land treatment, septic systems, hazardous waste, sewage disposal

Source: *National Water Quality Inventory: 1992 Report to Congress*, EPA, 1994.

Table 1-2. Five Leading Sources of Water Quality Impairment for Selected Classes of Waters

Rank	Rivers	Lakes	Estuaries
1	Agriculture	Agriculture	Municipal Point Sources
2	Municipal Point Sources	Urban Runoff / Storm Sewers	Urban Runoff / Storm Sewers
3	Urban Runoff / Storm Sewers	Hydrologic / Habitat Modification	Agriculture
4	Resource Extraction	Municipal Point Sources	Industrial Point Sources
5	Industrial Point Sources	Onsite Wastewater Disposal	Contaminated Sediments

Source: *National Water Quality Inventory, 1992 Report to Congress*, EPA, 1994.

lake acres, 3 percent of impaired estuary square miles, and negligible amounts of impairment in the Great Lakes and Coastal areas.[4]

1.2 THE NPDES STORM WATER PERMIT PROGRAM

The appropriate means of regulating storm water point sources within the NPDES program has been debated since the establishment of the NPDES program in 1972. Each attempt to devise a workable program has been the focus of substantial controversy concerning the water quality impacts, large number of storm water sources, nature of storm water runoff, and constraints of program priorities and resources.

1.2.1 Early Regulatory Approaches

In 1973, EPA promulgated regulations that exempted a number of categories of point sources from NPDES permit requirements, including: silvicultural point sources; CAFOs below a certain size; irrigation return flows from areas of less than 3,000 contiguous acres or 3,000 noncontiguous acres that use the same drainage system; nonfeedlot, nonirrigation agricultural point sources; and separate storm sewers containing only storm runoff uncontaminated by any industrial or commercial activity (38 *FR* 13530 (May 22, 1973)). The Agency maintained that exemptions were appropriate to conserve the Agency's enforcement resources for more significant point sources of pollution. In addition, the Agency noted that the characteristics of runoff pollution make it difficult to promulgate numeric effluent limitations for most of the point sources exempted by the 1973 regulations.

The Natural Resources Defense Council (NRDC) brought suit in the U.S. District Court for the District of Columbia challenging the Agency's authority to selectively exempt categories of point sources from permit requirements, *NRDC v. Train*, 396 F.Supp. 1393 (D.D.C. 1975), *aff'd, NRDC v. Costle*, 568 F.2d 1369 (D.C. Cir. 1977). The District Court held that EPA could not exempt discharges identified as point sources from regulation under

[4] *The Report of the EPA/State Feedlot Workgroup*, EPA, September 1993.

the NPDES permit program. However, in acknowledging the administrative burden placed on the Agency by requiring individual permits, the court recognized EPA's discretion to use certain administrative devices, such as area or general permits, to help manage its workload. In addition, the court recognized some discretion on EPA's part to define what constitutes a point source.

In response to the District Court's decision in *NRDC v. Train*, EPA issued a series of regulations addressing discharges from separate storm sewers (March 18, 1976, (41 *FR* 11307)), CAFOs (March 18, 1976, (41 *FR* 11458)), agricultural activities (July 12, 1976 (41 *FR* 28493)), silviculture activities (June 18, 1976 (41 *FR* 24709)), and aquaculture projects (May 17, 1977 (42 *FR* 25478)). Each of these regulations defined classes of point source discharges that would be subject to the NPDES permit program and exempted other classes of discharges from NPDES jurisdiction.

The regulations addressing NPDES requirements for agricultural activities defined the term agricultural point source to include any discernible, confined, and discrete conveyance from which any irrigation return flow is discharged into navigable waters. In response to these regulations, Congress amended the CWA in 1977 to specifically exclude return flows from irrigated agriculture from the definition of agricultural point source.[5] In 1987, Congress further amended the CWA to exclude agricultural storm water from the definition of agricultural point source.

The regulations addressing NPDES requirements for silvicultural activities defined the term silvicultural point source to include any discernible, confined, and discrete conveyance related to rock crushing, gravel washing, log sorting or log storage facilities which are

[5] *President Clinton's Clean Water Initiative* (1994) recommends that EPA, with the concurrence of the Departments of Agriculture and the Interior, and after consultation with States and other Federal agencies, should submit a report to Congress within two years after reauthorization of the CWA that evaluates the nature and extent of water quality problems presented by irrigation return flows, identifies the most promising and cost-effective technical and programmatic solutions to these problems, and recommends appropriate actions, including programmatic improvements and necessary legislative changes.

operated in connection with silvicultural activities and from which pollutants are discharged into navigable waters. The regulation clarified that the term did not include nonpoint source activities inherent to silviculture such as nursery operations, site preparation, reforestation and subsequent cultural treatment, thinning, prescribed burning, pest and fire control, harvesting operations surface drainage, and road construction and maintenance from which there is runoff.

The regulations addressing NPDES requirements for CAFOs clarified that CAFOs are point sources. CAFOs are defined as animal feeding operations that discharge to waters of the United States at times other than during events greater than a 25-year, 24-hour storm and that (1) have more than 1,000 animal units; (2) have more than 300 animal units and pollutants are discharged into navigable waters through a man-made flushing system or other man-made device, or pollutants are discharged directly into waters of the United States which originate outside of and pass over, across or through the facility or otherwise come into direct contact with the animals confined in the operation; or (3) are designated by EPA or an authorized NPDES State upon determining that it is a significant contributor of pollution to waters of the United States.

The regulations addressing NPDES requirements for concentrated aquatic animal production facilities (CAAPFs) clarified that CAAPFs are point sources. CAAPFs are defined as a hatchery, fish farm or other facility which harvest fish over specified limits or which is otherwise designated by EPA or an authorized NPDES State upon determining that it is a significant contributor of pollution to waters of the United States.

The regulations addressing separate storm sewers established a comprehensive permit program. This rule substantially increased the number of storm water discharges subject to the NPDES program. Permits continued to be required for conveyances carrying contaminated storm water runoff from areas used for industrial or commercial activities, as well as storm water discharges designated by the permit-issuing authority as significant

contributors of pollution. These sources were required to submit individual permit applications required of industrial and commercial process wastewater dischargers. In addition, the 1976 rule brought into the permitting program separate storm sewers defined as "a conveyance or system of conveyances . . . located in an urbanized area and primarily operated for the purpose of collecting and conveying storm water runoff." Channelized storm water runoff from rural areas that did not contain runoff from commercial or industrial activity was not defined as a point source unless designated otherwise by the permitting authority. Permit applications were not required for separate storm sewers at that time. EPA planned to study these discharges and issue general or area permits to address these sources because these discharges were expected to be less significant than runoff from industrial facilities. During this time, permitting efforts for storm water discharges focused on industrial facilities with effluent guideline limitations for their storm water discharges.[6]

On June 7, 1979, and May 19, 1980, EPA published comprehensive revisions to the NPDES regulations (44 *FR* 32854 (June 7, 1979); 45 *FR* 33290 (May 19, 1980)). These rules essentially retained the March 18, 1976, broad definition of storm water discharges subject to NPDES permit requirements but required more stringent application data for storm water point sources. Under these regulations, the same application information required of all industrial and commercial process wastewater dischargers would be required of all storm water point sources. The new requirements included testing under certain circumstances for a substantially greater number of pollutants identified in the 1977 amendments to the CWA.

This regulation brought suits in several Courts of Appeals and District Courts by numerous major trade associations, several of their member companies, NRDC, and Citizens for a Better Environment. The suits challenged many aspects of the NPDES regulations, including the storm water provisions. Eventually all petitions for review were consolidated

[6] The following effluent limitations guidelines address storm water or a combination of storm water and process water: cement manufacturing (40 *CFR* Part 411); concentrated animal feeding operations (40 *CFR* Part 412); fertilizer manufacturing (40 *CFR* Part 418); petroleum refining (40 *CFR* Part 419); phosphate manufacturing (40 *CFR* Part 422); steam electric (40 *CFR* Part 423); coal mining (40 *CFR* Part 434); mineral mining and processing (40 *CFR* Part 436); ore mining and dressing (40 *CFR* Part 440); and asphalt emulsions (40 *CFR* Part 443).

in the U.S. Court of Appeals for the D.C. Circuit (*NRDC v. EPA*, 673 F.2d 392 (DC Cir. 1980)).

After 2 years of intensive settlement negotiations with representatives of most of the petitioners, the Agency and industry petitioners signed a settlement agreement on July 7, 1982, which addressed a number of issues relating to the NPDES program, including storm water. Under the terms of the agreement, EPA agreed to changes to the storm water regulations which were finalized on September 26, 1984 (49 *FR* 37998).

The 1984 final rule recognized two fundamental issues regarding the NPDES regulation of storm water: (1) which storm water discharges should be classified as point sources, and, therefore, within the NPDES program and (2) what is the best way to regulate these sources. On the first issue, data available to EPA, such as the Nationwide Urban Runoff Program (NURP) study, indicated that there are water quality problems associated with storm water runoff. The final rule retained the broad coverage of the 1980 rule in mandating the permitting of all storm water point sources that discharge pollutants into waters of the United States. The September 26, 1984, rule defined a storm water point source as a channelized conveyance of storm water runoff that (1) is located in an urbanized area, as defined by the Bureau of the Census, (2) discharges from lands or facilities used for industrial or commercial activities, or (3) is designated by the Director of the NPDES Program.

To address the second issue of how to regulate these sources administratively, the final rule set forth two categories of storm water point sources, each with different application requirements. Group I storm water point sources were defined as sources either subject to effluent limitations guidelines, located at an industrial plant, or plant-associated area, or designated by the Director. All other storm water point sources were classified as Group II. Group I dischargers were required to submit the NPDES application form for industrial and commercial process wastewater discharges, including certain sampling and testing data. The application requirements for Group II were significantly reduced. Group II sources were

required to submit only Form 1 and a narrative description of the drainage area, receiving water, and any treatment applied to the discharge.

These storm water regulations generated considerable controversy (through post-promulgation comment) and, once again, suits were filed. The 1984 rules deleted the term "contaminated" and relied instead on geographic criteria to define sources subject to permitting. Some commenters claimed that the new definitions would subject thousands of discharges to the program for the first time. However, in EPA's view, the scope of coverage of storm water point sources under the NPDES program was essentially unchanged by the September 26, 1984, rulemaking.

Upon consideration of post-promulgation comments, EPA concluded that it would be appropriate to obtain additional data on storm water discharges to assess their significance as an environmental problem and to identify the best means of control. Although the number of dischargers required to submit quantitative testing data had been reduced by the 1984 rule, tens of thousands of storm water point sources remained to be identified, tested, and analyzed. Despite the improvements made in the 1984 regulation, EPA realized it was appropriate to request comments on whether the collection of data from each individual Group I discharger was necessary and efficient. In addition, EPA realized that new deadlines would need to be established. EPA published proposed changes to the storm water regulations on March 7, 1985, at 50 *FR* 9362 and on August 12, 1985, at 50 *FR* 27354. These proposals were not finalized because of the passage of the Water Quality Act of 1987.

1.2.2 Water Quality Act of 1987

Section 402(p) was added to the CWA in 1987 to require implementation of a comprehensive two-phased approach for addressing storm water discharges under the NPDES program. Section 402(p)(1) prohibits EPA or NPDES States from requiring permits for discharges composed entirely of storm water ("storm water discharges") until October 1, 1992 (this deadline was later extended to October 1, 1994, by the Water Resources

Development Act of 1992), except for the following five classes of Phase I storm water discharges specifically listed under Section 402(p)(2):

- Storm water discharges issued a permit before February 4, 1987
- Storm water discharges associated with industrial activity
- Discharges from a municipal separate storm sewer system serving a population of 250,000 or more
- Discharges from a municipal separate storm sewer system serving a population of 100,000 or more but less than 250,000
- Storm water discharges that EPA or an NPDES State determine to be contributing to a violation of a water quality standard or a significant contributor of pollutants to the waters of the United States.

Section 402(p)(3)(A) of the CWA requires storm water associated with industrial activity to meet all applicable provisions of Sections 402 and 301 of the CWA, including technology-based requirements and any necessary water quality-based requirements. Section 402(p)(3)(B) makes significant changes to the permit standards for discharges from municipal separate storm sewer systems.[7] Permits for discharges from municipal separate storm sewers:

- May be issued on a system- or jurisdiction-wide basis
- Shall include a requirement to effectively prohibit non-storm water discharges into the storm sewers
- Shall require controls to reduce pollutant discharges to the maximum extent practicable, including management practices, control techniques and system, design and engineering methods, and such other provisions determined appropriate for the control of such pollutants.

[7] The 1987 amendments to the CWA did not specifically address requirements for water quality-based permit conditions in NPDES permits for discharges from municipal separate storm sewer systems. EPA interprets the Act to require that permits for discharges from municipal separate storm sewers include any requirements necessary to achieve compliance with water quality standards.

Section 402(p)(4) of the CWA establishes statutory deadlines for the initial steps in implementing the Phase I program. Deadlines are established for the development of permit application regulations, submission of permit applications, issuance of permits for Phase I sources, and compliance with permit conditions.

The 1987 amendments did not identify what sources would be subject to the NPDES program after the temporary moratorium on permit requirements of Section 402(p)(1) expired. Rather, the amendments established a process for EPA to evaluate potential Phase II sources and designate sources for regulation to protect water quality. Section 402(p)(5) of the CWA requires EPA, in consultation with the States, to conduct a study of storm water discharges other than Phase I sources (i.e., potential Phase II sources). The study is to identify storm water discharges not covered under Phase I and determine, to the maximum extent practicable, the nature and extent of pollutants in such discharges. The study is also to establish procedures and methods to control storm water discharges to the extent necessary to mitigate impacts on water quality.

Section 402(p)(6) of the CWA requires EPA, in consultation with State and local officials, to issue regulations designating additional Phase II storm water discharges to be regulated to protect water quality and to establish a comprehensive program to regulate such designated sources. The comprehensive program to regulate such designated sources must, at a minimum, establish priorities, requirements for State storm water management programs, and expeditious deadlines. The program may include performance standards, guidelines, guidance, management practices, and treatment requirements, as appropriate.

1.2.3 Phase I Regulatory Framework

EPA promulgated regulations for Phase I storm water discharges on November 16, 1990 (55 *FR* 47990). These regulations clarified the scope of the Phase I storm water program by providing regulatory definitions for the major classes of storm water discharges identified under Section 402(p)(2)(B), (C), and (D) of the CWA:

- Storm water discharges associated with industrial activity
- Discharges from municipal separate storm sewer systems serving a population of 100,000 or more.[8]

In addition, the November 16, 1990, regulations established permit application requirements, including submittal deadlines, for these classes of discharges.

The November 16, 1990, regulations define municipal separate storm sewer systems serving a population of 100,000 or more to include municipal separate storm sewers within the boundaries of 173 incorporated cities and within unincorporated portions of 47 counties with populations of 100,000 or more in their unincorporated areas.[9] The regulations allowed for additional municipal separate storm sewers to be designated by the NPDES permitting authority (EPA or an authorized NPDES State) as being part of a municipal separate storm sewer system subject to Phase I requirements. In addition, the regulations established comprehensive two-part permit applications for discharges from municipal separate storm sewer systems serving a population of 100,000 or more. Among other things, the permit applications require municipal applicants to propose municipal storm water management programs to control pollutants to the maximum extent practicable and to effectively prohibit non-storm water discharges to the municipal system.[10] Municipal storm water management programs are a combination of source controls and management practices that address targeted sources within the boundaries of the municipal system. Under this program, EPA has defined the role of municipalities in a flexible manner that allows local governments to assist in defining priority pollutant sources within the municipality and to develop and

[8] Consistent with Section 402(p)(2) of the CWA, the November 16, 1990, regulations address two subclasses of municipal separate storm sewer systems serving a population of 100,000 or more. Large municipal separate storm sewer systems are defined as systems serving a population of 250,000 or more (40 *CFR* 122.26(b)(4)). Medium municipal separate storm sewer systems are defined as systems serving a population of 100,000 or more, but less than 250,000 (40 *CFR* 122.26(b)(7)).

[9] See Appendices F, G, H, and I to 40 *CFR* 122.

[10] See 40 *CFR* 122.26(d)(2)(iv).

implement appropriate controls for such discharges. Municipal programs can establish requirements for the control of discharges to the municipal system from privately owned lands (e.g., sediment and erosion control for construction sites) and can address municipal activities that affect storm water quality (e.g., maintenance of leaking sanitary sewers, road de-icing and maintenance, operation of municipal landfills, and some flood control efforts).

Moreover, the November 16, 1990, regulations defined the term "storm water discharges associated with industrial activity" to include 11 categories of industrial facilities (see 40 *CFR* 122.26(b)(14)) and established application requirements for such discharges.[11] In light of concerns raised by the industrial community about the complexity of the November 1990 storm water regulations, the difficulty in determining whether particular facilities were subject to the new rules, and administrative delays in permit issuance, EPA issued a series of extensions to permit application deadlines for discharges associated with industrial activity.[12] With these extensions, October 1, 1992, was established as the date by which any facility with a storm water discharge associated with industrial activity must submit either an individual or group application or obtain coverage under an applicable general permit.

Congress also has acted to grant extensions to the application deadlines for selected classes of discharges associated with industrial activity. In March 1991, Congress adopted Section 307 of the Dire Emergency Supplemental Appropriations Act of 1991, which ratified EPA's extension of Part I of the group applications to September 30, 1991. On December 18, 1991, the Intermodal Surface Transportation Efficiency Act of 1991 (or Transportation Act), extended NPDES permit application deadlines for storm water discharges associated with industrial activity from facilities that are owned or operated by municipalities. In addition, Section 1068(c) of the Transportation Act amended the Clean Water Act to provide

[11] As discussed below, on June 4, 1992, the U.S. Court of Appeals for the Ninth Circuit found EPA's rationale for exempting construction sites of less than 5 acres and certain uncontaminated storm water discharges from light industrial facilities from Phase I of the storm water program to be invalid and has remanded these exemptions for further proceedings (see *NRDC v. EPA*, 966 F.2d 1292 (9th Cir. 1992)).

[12] See 56 *FR* 12098 (March 21, 1991), 56 *FR* 56548 (November 5, 1991), 57 *FR* 11524 (April 2, 1992).

that EPA shall not require any municipality with a population of less than 100,000 to apply for or obtain a permit for any storm water discharge associated with industrial activity other than an airport, power plant, or uncontrolled sanitary landfill owned or operated by such municipalities before October 1, 1992. In response to this provision, EPA has reserved application deadlines for these facilities.[13]

EPA also has modified the NPDES regulations to provide a greater degree of emphasis on site inspections as an alternative or supplement to discharge monitoring in permits for storm water discharges associated with industrial activity.[14]

On June 4, 1992, the United States Court of Appeals for the Ninth Circuit issued an opinion granting in part a petition for review of EPA's 1990 storm water regulations (*NRDC* v. *EPA*, 966 F.2d 1292 (9th Cir. 1992)). The court upheld several provisions of the regulations, including the definition of municipal separate storm sewer system, the standards for municipal storm water controls, the scope of the permit exemption for oil and gas operations, and EPA's decision not to provide public comment on Part 1 of the group applications for storm water discharges associated with industrial activity.

The Court did declare EPA's extension of the statutory deadlines for storm water permit applications to be unlawful, but declined to strike down the deadlines as the plaintiff had requested. In addition, the Court struck down and remanded two exemptions from the definition of storm water discharges associated with industrial activity.

One of the remanded exemptions addressed construction activities that result in the disturbance of less than 5 acres of total land area which are not part of a larger common plan of development or sale. EPA noted that State and local sediment and erosion controls may

[13] See 57 *FR* 11524 (April 2, 1992), 40 *CFR* 122.26(e)(1)(ii).

[14] See 57 *FR* 11524 (April 2, 1992), 40 *CFR* 122.44(i).

address construction activities of less than 5 acres and that the acreage limit reflected land disturbances that were industrial in magnitude because disturbances on large tracts of land will employ more heavy machinery and industrial equipment. The Court noted that EPA had proposed to exempt only sites for commercial and industrial construction smaller than 1 acre and sites for residential construction smaller than 5 acres. In the final rule, the exemption was increased to 5 acres for all construction sites, based on the Agency's determination that smaller sites would not have levels of activity similar to other industrial activities. The court ruled, however, that the record did not indicate "that construction sites on less than five acres are non-industrial in nature" (966 F.2d at 1306). The court rejected EPA's argument that the 5-acre cutoff constituted a *de minimis* exemption, because the record lacked information to suggest whether smaller discharges would be *de minimis*.

A second remanded exemption addressed light manufacturing facilities where material handling equipment or activities, raw material, intermediate products, final products, waste materials, byproducts, or industrial machinery are not exposed to storm water. With respect to the light industry category, EPA had adopted the exemption based on the belief that if (1) the activities in the selected facilities are undertaken in buildings; (2) emissions from stacks are minimal or nonexistent; (3) there is no unhoused manufacturing and heavy industrial equipment, outside storage, disposal, or handling of raw, finished, or waste materials; (4) and the activities being performed do not generate significant dust or particulates, the facility posed a much smaller risk of storm water contamination. Based on these factors, the Agency believed that these facilities were similar to commercial businesses, such as retail and service facilities.

The court noted, however, that the statutory term associated with industrial activity was very broad and concluded that Congress intended only to exempt discharges from non-industrial facility areas such as parking lots. The court rejected EPA's argument that industrial pollutant levels in storm water would be minimal at light industrial facilities,

finding nothing in the record to support that conclusion. Therefore, the court found this exemption to be arbitrary and capricious (966 F.2d at 1304-05).

In response to the Ninth Circuit decision, EPA promulgated rules on December 18, 1992, specifying dates for permit approval or denial and permit compliance. In the December 18, 1992, notice, EPA also noted that it did not believe that the court's opinion had the effect of automatically subjecting small construction sites and light industries to the existing application requirements and deadlines for storm water discharges associated with industrial activity. The Agency also indicated that it believed that additional notice and comment rulemaking was necessary to clarify the status of these facilities under the storm water program.

1.2.4 Phase I Implementation Activities

The initial efforts to implement the Phase I storm water program have focused on reviewing group applications for industrial storm water, issuing general permits for industrial storm water, publishing draft general permits for storm water discharges from 29 industrial sectors, reviewing applications for municipal separate storm sewer systems, issuing permits for municipal separate storm sewer systems, and conducting outreach activities. In addition, the Agency, in conjunction with the Rensselaerville Institute, completed a study to develop recommendations for making Phase I of the program more effective.

1.2.4.1 General Permits

In September 1992 (April 1993 for Puerto Rico) EPA issued general permits for storm water discharges associated with industrial activity in the 11 States without NPDES authority, as well as for Territories, States where EPA issues permits for Federal facilities, and Federal Indian Reservations. Unlike traditional NPDES permits, these permits generally do not

establish numeric effluent limitations for most discharges authorized by the permits.[15] Rather, the permits establish requirements for notices of intent, site inspections conducted by dischargers, and site-specific pollution prevention plans. The requirements for pollution prevention plans provide a framework for dischargers to identify sources of pollution and best management practices to prevent, reduce and/or control such pollutant sources. In addition, targeted facilities are required to sample and analyze their storm water discharges.

When the storm water application rules were issued in November 1990, only 17 out of the 39 authorized States authorized to administer the NPDES program were also approved to issue NPDES general permits. Since then, an additional 21 States have requested and received EPA approval to issue general permits, and one additional State has received NPDES authorization, including general permit authority. All but one of the States that now have general permit authority have issued general permits for storm water discharges.

1.2.4.2 Group Applications

EPA has received more than 1,200 Part I group applications representing more than 60,000 industrial facilities with storm water discharges. EPA has requested public comment on draft permits to address discharges identified in these applications that are in States without authorized NPDES programs.[16] The draft general permits contain requirements for 29 different industrial sectors.

1.2.4.3 Municipal Applications

Permit applications have been received for almost all municipal separate storm sewer systems serving a population of 100,000 or more. This represents a substantial initial

[15] The permits do establish numeric effluent limitations for some classes of storm water discharges. These limitations are either based on best available technology or established pursuant to State certifications under Section 401 of the CWA.

[16] See 58 *FR* 61146 (November 19, 1993).

investment into Phase I of the storm water program by municipalities.[17] At the heart of these applications are proposed municipal storm water management programs, which will identify a variety of site-specific pollution prevention measures, source controls, and best management practices to control pollutants from targeted sources within the municipality.[18] EPA and authorized NPDES States have started to issue permits for these municipal separate storm sewer systems. The Agency estimates that 263 permits will be issued for Phase I municipal separate storm sewer systems; as of May 1994, 24 permits have been issued.

1.2.4.4 Rensselaerville Phase I Effort

In 1992 EPA completed a study, in conjunction with the Rensselaerville Institute, to obtain direct public input and develop recommendations for improving Phase I of the storm water program. These studies are discussed in more detail in Appendix I. The study raised five key issues relating to Phase I sources:

- Study participants thought that EPA has not been clear enough about the intended goals of the regulations and should communicate storm water risks, objectives, and requirements more clearly to the general public, as well as to the regulated community.
- Participants noted that the cost of program implementation is significantly higher than original EPA estimates and that there is great concern regarding the real costs of the program and of achieving compliance.
- Participants agreed that EPA and States must accelerate general permit issuance and focus on general permits to achieve efficient implementation of the program.

[17] The National Association of Flood and Stormwater Management Agencies estimates based on a 1992 survey that municipalities have spent more than $130 million on preparing NPDES permit applications for discharges from Phase I municipal separate storm sewer systems.

[18] A review of cost estimates for proposed municipal storm water management programs provided in 20 applications indicates that municipalities estimate the cost of program implementation (excluding permit application costs) to range from $23.91 to $37.00 per person. (See draft *Review of Program Costs in Part 2 NPDES Municipal Storm Water Permit Applications*, EPA, 1993.)

- Participants felt that technical outreach should be targeted at the State and local level rather than the national level and should provide better guidance on the regulations and their implementation.

- Participants noted that coverage under certain industrial storm water categories should be clarified.

EPA agreed with these recommendations and has taken steps to follow up in each area.

1.2.5 September 9, 1992 Notice—Phase II Issues

On September 9, 1992, EPA published a notice requesting information and public comment on the Phase II program. The notice is included in Appendix H of this report. The notice identified three sets of issues associated with developing Phase II regulations:

- How should sources that are to be subject to Phase II regulations be identified?
- What types of control strategies should be developed for these sources?
- What are appropriate deadlines for implementing Phase II requirements?

The September 9, 1992, notice presented a range of alternatives under each issue in an attempt to illustrate, and obtain input on, the full range of potential approaches for a Phase II strategy. The notice recognized that potential sources for coverage under Phase II fall into two main categories: municipalities; and individual sources (commercial and residential) activities. EPA recognized that a major distinction between most options for identifying Phase II commercial/residential sources was either to require targeted municipalities to develop source controls and management programs for storm water discharges within their jurisdictions or to require permits for discharges from individual facilities.

EPA received more than 130 comments on the September 9, 1992, notice. Approximately 43 percent of the comments were from municipalities, 29 percent from trade groups or industries, 24 percent from State or Federal agencies, and approximately 3 percent

from other miscellaneous sources.[19] No comments were received from environmental groups. Appendix J contains a detailed summary of comments received as they relate to the specific issues raised in the notice.

1.2.6 Rensselaerville Phase II Effort

In early 1993, the Rensselaerville Institute and EPA held public and expert meetings to assist in developing and analyzing options for identifying Phase II sources and controls. These meetings and the resulting options are discussed in more detail in Appendix I of this report. The report on the effort indicates that the two options most favored by the various groups participating were:

- A program where States would select sources to be controlled in a manner that was consistent with criteria developed by EPA. The Phase II program would provide States with flexibility to either rely on NPDES requirements or other frameworks to control targeted sources.
- A tiered approach that would provide for EPA selection of high priority sources for control by NPDES permits and State selection of other sources for control under a State program other than the NPDES program.

1.2.7 President Clinton's Clean Water Initiative

On February 1, 1994, *President Clinton's Clean Water Initiative* was issued. The *President's Initiative* addresses a number of issues associated with NPDES requirements for storm water discharges, including:

- Compliance of discharges from municipal separate storm sewer systems with water quality standards
- Industrial facilities with no activities or significant materials exposed to storm water
- Deadline extensions for Phase II of the storm water program

[19] Percentages have been rounded off, and hence may not total 100 percent.

- Phase II storm water program requirements, including regulation of storm water from industrial facilities by municipalities
- Control of discharges from inactive and abandoned mines (IAMs) located on Federal lands.

To address municipal compliance with water quality standards, the *President's Initiative* recommends that the CWA be amended to establish a phased permit compliance approach that requires best management practices in first-round municipal storm water permits and improved best management practices in second-round permits, where necessary, to move towards compliance with water quality standards. In later permits, compliance with water quality standards will occur using water quality-based effluent limits, where necessary. This would give EPA and municipalities additional time to evaluate the technical feasibility of establishing numeric effluent limits to meet water quality standards and give States time to develop specific water quality standards appropriate for storm water discharges, if necessary. The *President's Initiative* further supports clarifying authority under section 402(p)(3)(B) concerning "maximum extent practicable" (MEP).

The *President's Initiative* recommends that EPA be authorized to exempt from individual storm water permitting requirements facilities that can certify that there is no—nor will there be—exposure of industrial or other activities or significant materials to rain water and snow melt. This change would ensure that several hundred thousand low-risk facilities are not subject to NPDES requirements, allowing allocation of resources to more critical areas. This would also effectively create incentives for facilities to eliminate contamination of storm water.

The *President's Initiative* recommends that the statutory deadline for EPA to issue Phase II regulations be extended. The *President's Initiative* also recommends that the deadline for Phase II sources to obtain a permit be extended. The *President's Initiative* indicated that extensions would allow EPA to work with States and municipalities in developing workable, effective regulations. A new deadline for permits would give municipalities an opportunity

to begin to build institutional frameworks and provide the funding necessary to implement storm water management programs. It would also allow permits to be issued to Phase II municipalities at the same time Phase I permits are expiring. This would promote regional and watershed-wide permitting by allowing different municipalities to be co-applicants and to coordinate their storm water programs.

With respect to NPDES requirements for Phase II storm water discharges, the *President's Initiative* recommends[20] that NPDES Phase II requirements for storm water focus on system-wide permits for municipal separate storm sewer systems in Census-designated urbanized areas.[21] The *President's Initiative* recommends tiered permitting requirements. Storm water management programs would be developed for municipal separate storm sewer systems located within an urbanized area in which a municipal separate storm sewer system is already addressed under Phase I. The programs would, at a minimum, address non-storm water discharges into storm sewers and storm water runoff from growth and development and significant redevelopment. NPDES permitting authorities should be encouraged to implement watershed approaches which implement a more comprehensive municipal storm water management program where appropriate based on water quality impairments or other factors for municipal separate storm sewer systems in these urbanized areas. In the remaining Census-designated urbanized areas, municipal storm water management programs would be required which focus only on controlling non-storm water discharges into storm sewers and storm water runoff from growth, development, and significant redevelopment activities. The *President's Initiative* recommends that Phase II of the NPDES program not directly regulate Phase II light industrial, commercial, retail, and

[20] While the *President's Initiative* generally speaks to recommended statutory changes, EPA notes that under the existing CWA, with the exception of extending the deadline for permits for discharges from municipal separate storm sewer systems to comply with water quality-based requirements, EPA could issue Phase II regulations covering the same facilities to the same extent as suggested in the *President's Initiative*.

[21] The Bureau of the Census defines urbanized areas as a central city (or cities) with a surrounding area that is densely settled (i.e., urban fringe). The population of the entire urbanized area must be greater than 50,000 persons, and the urban fringe must have a population density generally greater than 1,000 persons per square mile (approximately 1.5 persons per acre). A complete description of the Bureau of the Census definition is provided in Chapter 3.

institutional storm water discharges, and municipalities outside of Census-designated urbanized areas unless designated by the permitting authority for inclusion in the NPDES program under Section 402(p)(2)(E) of the CWA. Rather, such discharges, if a targeted source, should be addressed by Nonpoint Source programs.

The *President's Initiative* recommends authorizing municipalities to directly control Phase I industrial storm water facilities within their jurisdictions under the NPDES program. This recommendation is similar to the industrial pretreatment program currently authorized under the CWA. The *President's Initiative* recommends clarifying authority to issue permits on a statewide basis for IAMs, allowing Federal land managers to establish priorities and make the most effective use of available resources. Land managers would be allowed up to 10 years to meet appropriate water quality standards, while continuing to identify additional impacts from IAMs and implementing targeted controls once identified. A cost-benefit analysis was prepared for the *President's Initiative* and is summarized in Appendix L. No further cost-benefit analyses were conducted for this report.

1.2.8 NPDES Watershed Strategy

EPA issued the NPDES Watershed Strategy in March 1994. The Strategy discusses integration of NPDES program functions into a broader watershed protection approach and areas for coordination with stakeholders to promote implementation of the approach. The NPDES Watershed Strategy is based on the following principles:

- Watershed protection approaches may vary in terms of specific elements, timing, and resources, but all should share a common emphasis and insistence on integrated actions, specific action items, and measurable environmental and programmatic milestones.
- Related activities within a basin or watershed must be coordinated to achieve the greatest environmental benefit and most effective level of stakeholder involvement.

- Actions relating to restoration and protection of surface water, ground water, and habitat within a basin should be based upon an integrated decision-making process, a common information base, and a common understanding of the roles, priorities, and responsibilities of all stakeholders within a basin.
- Staff and financial resources are limited and must be allocated to address environmental priorities as effectively and efficiently as possible.
- Program requirements that interfere or conflict with environmental priorities should be identified and revised to the extent possible.
- Accurate information and high quality data are necessary for decision-making and should be collected on an incremental basis; interim decisions should be made based on available data to prevent further degradation and promote restoration of natural resources.

1.3 RELATED NONPOINT SOURCE PROGRAMS

1.3.1 Section 319 of the CWA

In 1987, Section 319 was added to the CWA to provide a framework for funding State and local efforts to address pollutant sources not addressed by the NPDES program (e.g., nonpoint sources). To obtain funding, States were required to submit Nonpoint Source Assessment Reports identifying State waters that, without additional control of nonpoint sources of pollution, could not reasonably be expected to attain or maintain applicable water quality standards or the goals and requirements of the CWA. States were also required to prepare and submit for EPA approval a statewide Nonpoint Source Management Program for controlling nonpoint source water pollution to navigable waters within the State and improving the quality of such waters. State program submittals were to identify specific best management practices (BMPs) and measures that the State proposes to implement in the first 4 years after program submission to reduce pollutant loadings from identified nonpoint sources to levels required to achieve the stated water quality objectives.

State programs funded under Section 319 can include both regulatory and nonregulatory State and local approaches. Section 319(b)(2)(B) specifies that a combination of "non-regulatory or regulatory programs for enforcement, technical assistance, financial assistance,

education, training, technology transfer, and demonstration projects" may be used, as necessary, to achieve implementation of the BMPs or measures identified in the Section 319 submittals.

Although most States have generally emphasized the use of voluntary approaches in their 319 programs, some States and local governments have implemented regulations and policies to control pollution from urban runoff. States such as Delaware and Florida, as well as local jurisdictions such as the Lower Colorado River Authority, are pursuing storm water management goals through numerical treatment standards for new development. Many States and local governments have enforceable erosion and sediment control regulations. On a broader scale, nonpoint source pollution is being addressed at the watershed level by programs such as those being implemented by the State of Wisconsin, the Puget Sound Water Quality Authority, the States that are parties to the Great Lakes Water Quality Agreement, and other States. A number of individual States and local communities have adopted legislation or regulations similar to Maryland's Critical Areas Act, which limits development and/or requires special management practices in areas surrounding water resources of special concern.

1.3.2 Section 6217 of CZARA

Section 6217 of the Coastal Zone Act Reauthorization Amendments (CZARA) of 1990 provides that States with approved coastal zone management programs must develop and submit coastal nonpoint pollution control programs to EPA and the National Oceanic and Atmospheric Administration (NOAA) for approval. Failure to submit an approvable program will result in a reduction of Federal grants under both the Coastal Zone Management Act and Section 319 of the CWA.

State coastal nonpoint pollution control programs under CZARA must include enforceable policies and mechanisms that ensure implementation of the management measures throughout the coastal management area. Section 6217(g)(5) defines management measures

as "economically achievable measures for the control of the addition of pollutants from existing and new categories and classes of nonpoint sources of pollution, which reflect the greatest degree of pollutant reduction achievable through the application of the best available nonpoint pollution control practices, technologies, processes, siting criteria, operating methods, or other alternatives." Congress mandated a technology-based approach based on technical and economic achievability under the rationale that neither States nor EPA have the money, time, or other resources to create and expeditiously implement a program that depends on establishing cause and effect linkages among particular land use activities and specific water quality problems. If this technology-based approach fails to achieve and maintain applicable water quality standards and to protect designated uses, CZARA Section 6217(b)(3) requires additional management measures.

EPA issued *Guidance Specifying Management Measures for Sources of Nonpoint Pollution in Coastal Waters* under Section 6217(g) in January 1993. The Guidance identifies management measures for five major categories of nonpoint source pollution: Agriculture, Forestry, Urban, Marinas and Recreational Boating, and Hydromodification. The management measures reflect the greatest degree of pollutant reduction that is economically achievable for each of the listed sources. These management measures provide reference standards for the States to use in developing or refining their coastal nonpoint programs. In general, the management measures were written to describe systems designed to reduce the generation of pollutants. A few management measures, however, contain quantitative standards that specify pollutant loading reductions.[22] The management measures approach was adopted to provide State officials flexibility in selecting strategies and management systems and practices that are appropriate for regional or local conditions, provided that equivalent or higher levels of pollutant control are achieved. Appendix K of this report summarizes the management measures for urban areas, animal feedlots, and marinas that were identified in the guidance.

[22] For example, the New Development Management Measure, which is applicable to construction in urban areas, requires: (1) that by design or performance that the average annual total suspended solid loadings be reduced by 80 percent; and (2) to the extent practicable, that the predevelopment peak runoff rate and average volume be maintained.

Storm water discharges regulated under Phase I of the NPDES program, such as discharges from municipal separate storm sewers serving a population of 100,000 or more and construction activities that disturb 5 or more acres, do not need to be addressed in Coastal Nonpoint Pollution Control Programs. However, potential Phase II sources, such as urban development adjacent to or surrounding Phase I municipal systems, smaller urbanized areas, and construction sites that disturb less than 5 acres, that are identified in management measures under Section 6217 guidance need to be addressed in Coastal Nonpoint Pollution Control Programs until such discharges are issued an NPDES permit. EPA and NOAA have worked, and continue to work, together in their activities to ensure that there is not an overlap of authorities between NPDES and CZARA.

EPA and NOAA published *Coastal Nonpoint Pollution Control Program: Program Development and Approval Guidance*, which addresses such issues as the basis and process for EPA/NOAA approval of State Coastal Nonpoint Pollution Control Programs; how EPA and NOAA expect State programs to implement management measures in conformity with EPA guidance; and procedures for reviewing and modifying State coastal boundaries to meet program requirements. The guidance clarifies that States generally must implement management measures for each source category identified in the guidance developed under Section 6217(g). This guidance sets quantitative performance standards for some measures. Coastal Nonpoint Pollution Control Programs are not required to address sources that are clearly regulated under the NPDES program as point source discharges. The guidance also clarifies that regulatory and nonregulatory mechanisms may be used to meet the requirement for enforceable policies and mechanisms, provided that nonregulatory approaches are backed by enforceable State authority ensuring that the management measures will be implemented. Backup authority can include sunset provisions for incentive programs. For example, a State may provide additional incentives if too few operators participate in a tax incentive program or develop mandatory requirements to achieve the necessary implementation of management measures.

1.3.3 President Clinton's Clean Water Initiative—Nonpoint Source Programs

President Clinton's Clean Water Initiative proposes a fundamental restructuring and strengthening of the nonpoint source pollution (NPS) control programs under Section 319 of the CWA. The *President's Initiative* proposes legislative changes that will result in upgraded and strengthened existing State NPS management programs within seven and one-half years of reauthorization of the CWA. These programs will implement best available management measures for nonpoint sources causing, contributing to, or threatening water quality impairments and for new nonpoint sources, except for new sources in States with an approved watershed management program. The *President's Initiative* recommends that the initial implementation period be followed by a second, five-year period to implement further measures where necessary (considering the actual and expected environmental benefits of the original management measures) to achieve water quality standards.

The *President's Initiative* recommends that strengthened Section 319 State programs rely on a mix of voluntary and regulatory approaches and that State programs include enforcement authorities to be used as needed to ensure implementation of management measures. Under the proposal, State authorities will be backed by Federal enforcement authorities to be exercised if a State should fail to implement the management measures. Where States do not develop an approvable program, Section 319 grants will be withheld from the State and EPA will be authorized to establish enforceable minimum NPS controls. The *President's Initiative* proposes that funding be increased for State implementation of NPS programs and that State revolving loan fund eligibility be clarified for NPS projects whose principal purpose is protecting and improving water quality. The *President's Initiative* also proposes that the CWA be clarified to require that Federal agencies comply with State or local requirements in nonpoint source programs to the same extent as non-Federal parties.

1.3.4 President Clinton's Clean Water Initiative—Watershed Management

President Clinton's Clean Water Initiative proposes that provisions for comprehensive watershed management be added to the CWA. Under the proposal, States can choose to

implement comprehensive watershed programs which will be approved by EPA after conference with other Federal agencies. The States will determine the boundaries for all watersheds in the State and set a schedule for addressing them. States will oversee watershed management entities with appropriate representation of stakeholder interests and approve their watershed management plans. State watershed plans will include rankings based on environmental objectives as well as evidence of enforceable policies and mechanisms needed to implement the plans.

The *President's Initiative* proposes other changes to the CWA that: (1) provide guidelines for States wishing to adopt market-based approaches to point and NPS pollution controls within watersheds; (2) promote the development of wetland management plans that lead to increased flexibility and predictability of the wetlands permit process on a watershed basis; and (3) create comprehensive State inventories of waters that are threatened, impaired, or in need of special protection. The *President's Initiative* also recommends that States give urban watersheds a high level of priority in their State-wide ranking of watershed initiatives.

1.4 DEVELOPMENT OF THIS REPORT

A Draft of this report was circulated extensively in November 1993. Copies were distributed to States, EPA Regions, the Association of State and Interstate Water Pollution Control Administrators (ASIWPCA), and other interested parties. Comments received on that draft have been reviewed and appropriate changes to the Report have been made.

1.5 ORGANIZATION OF THIS REPORT

Chapter 2 of this report presents the approach and methodology for identifying categories of storm water sources and methods for estimating the distribution and content of these discharges. The next two chapters identify storm water discharges not regulated by the current program and discusses the nature of such discharges and the extent of pollutant loadings from these sources, as well as their geographic distribution for municipalities (Chapter 3) and industrial and commercial facilities (Chapter 4).

CHAPTER 2. APPROACH

This chapter describes the approach taken by the U.S. Environmental Protection Agency (EPA) to identify and characterize storm water discharges that are not subject to the first phase of the National Pollutant Discharge Elimination System storm water permit requirements under Section 402(p) of the Clean Water Act (CWA).

The study considered two major classes of storm water discharges: (1) discharges from municipal separate storm sewer systems (addressed in Section 2.2) and (2) industrial and commercial discharges (Section 2.3). EPA relied on existing information and data, particularly the 1990 U.S. census, and on a number of previous studies, as described in the literature review (Section 2.4). As a part of this study, EPA developed estimates of annual loadings for discharges from municipal separate storm sewer systems. Section 2.1 gives a brief overview of the approach.

2.1 OVERVIEW OF APPROACH

A main purpose of this report is to identify storm water discharges not addressed by Phase I of the NPDES program for storm water discharges and to determine the nature and extent of pollutants in these discharges. The analytical approach to this objective followed two separate paths—one for Phase II discharges from municipal separate storm sewer systems and another for individual Phase II sources. This section briefly summarizes both aspects of the approach. Sections 2.2 and 2.3 provide more detailed explanation.

In the analysis of municipal separate storm sewer systems, municipal systems addressed by Phase I of the NPDES program had to be identified to allow identification of the remaining potential Phase II municipal systems. EPA limited the analysis of potential Phase II municipal separate storm sewer systems to those municipalities that had populations that were classified as urban by the Bureau of the Census. Census information was used to identify the type of municipality, geographic location, and urban population. Selected

geographic areas of potential concern, such as urbanized areas, coastal areas, and fast growing areas, were identified and evaluated following the procedures described below.

Pollutant loading estimates were developed for populations located in urbanized areas that were designated by the Bureau of the Census, including both Phase I and Phase II discharges. Pollutant loadings were estimated by using a simplified loadings model described in Section 2.2.2. Pollutant concentration data for seven pollutants, including conventional pollutants, nutrients, and metals, were taken from the results of the National Urban Runoff Program (NURP) (EPA, 1983). Runoff volume was estimated as the product of land area, the annual amount of precipitation, and the "runoff coefficient" (a fraction that indicates the proportion of precipitation that runs off the land and enters receiving waters). Land area for urbanized areas was provided by the 1990 U.S. census. Precipitation estimates were based on the rainfall zones established in the NPDES Permit Application Requirements for Storm Water Discharges (November 16, 1990). The runoff coefficient is a function of the imperviousness of the land surface, which is related to the density of roads, buildings, and other paved surfaces in an urban area. The amount of impervious area in urban settings can be estimated from population densities. The runoff coefficient used in this analysis was estimated by using a relationship based on population density (calculated from census data) that was published in the technical literature and in EPA documents (Heaney et al., 1977).

In the analysis of individual Phase II sources, identification of potential sources also proceeded in two steps. First, a review of the regulatory definition identified which types of facilities were clearly regulated under Phase I. This review aided the development of a list of facilities similar or identical to Phase I industrial facilities that were not covered under Phase I for a variety of statutory and regulatory reasons. Second, a literature review (see Section 2.4) identified, in general terms, additional commercial and retail sources of potential concern, based on the types of pollutants used or activities conducted. These potential Phase II sources were specified in detail using the Standard Industrial Classification (SIC) code system of the Office of Management and Budget. The use of SIC codes for identification of

potential Phase II sources also facilitated the quantitative analysis performed in Chapter 4. Thus, the identification step covered the full range of industrial and commercial business activities that may be contributing to storm water pollution. A complete listing of industries classified within the SIC code system is provided later in this section.

The nature and extent of pollutants from individual Phase II sources were determined in two parts. The nature of pollutants was addressed qualitatively in two steps. First, pollutant sampling data from Phase I industrial sources was evaluated, summarized, and compared to previous studies of urban storm water content. This formed a basic reference on the nature of discharges from a wide variety of specific industrial categories. Second, potential Phase II sources were classified into groups and compared with Phase I sectors, where possible, to enable comparison to the pollutant concentration data from Phase I facilities and to determine the types and quantities of pollutants likely to be associated with unregulated discharges. This qualitative assessment of potential pollutant associations was supplemented with information documented in State and local nonpoint source programs, urban runoff programs, estuary programs, and technical articles identified through the literature review.

The extent of potential Phase II individual discharges was addressed by determining the geographic location and distribution of facilities that may contribute pollutants to storm water, rather than calculating pollutant loads as in the municipal analysis. The analysis focused on location rather than loadings because data on industrial and commercial pollutant discharges was insufficient to allow estimation of loadings on a national basis. Moreover, an attempt to estimate loads for industrial and commercial sources would lead to double counting, because many potential Phase II facilities are located in municipal or urban areas and the loading analysis for municipal sources already accounts for some of their contributions.

Using EPA's Facility and Company Tracking System (FACTS) computer file based on Dun & Bradstreet information about economic activity, the number of facilities in each SIC

code was found for each county in the country.[1] From the 1990 census for each county, the proportion of population associated with geographic jurisdictions of interest was calculated. For each county and each SIC code, the number of facilities was multiplied by the proportion of population in each geographic area to yield an estimate of the number of facilities in that portion of the county. Summing over all counties provides an estimate of the proportion of facilities in each SIC code nationally that are located in the geographic jurisdictions of interest.

The two paths, municipal separate storm sewer systems and individual sources, were related through the geographical analysis of extent of discharges, which shows the proportion of pollutant loadings from municipal separate storm sewers and the proportion of individual facilities associated with various areas of concern. Although the effect cannot be quantified, the nature and extent of pollutants from industrial and commercial sources overlaps with the nature and extent of pollutant loadings calculated in the municipal analysis.

2.2 ANALYSIS OF MUNICIPAL SEPARATE STORM SEWER SYSTEMS

This section describes the procedure used to identify potential Phase II municipal separate storm sewer systems. The section also explains how the pollutant load estimates were developed for discharges from municipal separate storm sewer systems in urbanized areas.

2.2.1 Identifying Municipal Separate Storm Sewer Systems

Municipal separate storm sewer systems addressed by Phase I of the NPDES program had to be identified to allow identification of the remaining potential Phase II municipal systems. EPA limited the analysis of potential Phase II municipal separate storm sewer

[1] The FACTS data base is leased by EPA from Dun & Bradstreet Information Services, which created, maintains, and annually updates the information based on State and industry reports and on primary data collection in the business community, including detailed surveys and personal interviews. It has been estimated that this data base accounts for more than 96 percent of the U.S. Gross National Product (Caskins, 1992). FACTS was made available for this study through EPA's National Computer Center in North Carolina.

systems to populations that were classified as urban by the Bureau of the Census. The only other population classification available from the Bureau of the Census was rural populations. Rural populations and rural areas were generally excluded from this part of the analysis because the Agency was generally unable to tie these areas to development patterns and demographics that were thought to result in the installation of municipal separate storm sewer systems. Census information was used to identify the type of municipality, geographic location, and urban population.

2.2.1.1 Phase I Definitions

Section 402(p) of the CWA identifies discharges from municipal separate storm sewer systems serving a population of more than 100,000 people as requiring permit coverage under the first phase of the NPDES program. Phase I municipal systems are defined in the NPDES regulations at 40 *CFR* 122.26(b)(4) and (7) and explained in the preamble to include:

- Incorporated cities with populations greater than 100,000 served by separate storm sewers, according to the latest Decennial Census by the Bureau of the Census
- Counties with a population of 100,000 or more in unincorporated, urbanized areas, according to the latest Decennial Census by the Bureau of the Census (excluding the population of towns and townships)
- Municipalities that are designated by EPA or an authorized NPDES State.[2]

Phase I municipal systems also include systems that are designated by EPA or an authorized NPDES State under section 402(p) of the CWA as needing an NPDES permit because they are significant contributors of pollutants to waters of the United States or contribute to a violation of water quality standards.

[2] Designation of a Phase I municipal system is based on one of the following factors: physical interconnections with a municipal separate storm sewer system serving a population of 100,000 or more identified in the NPDES regulations, discharges from several municipal separate storm sewer systems, the quantity and nature of pollutants in the discharge, and the nature of the receiving waters.

For the purposes of determining Phase I populations, the NPDES regulations allow municipalities to reduce the population of the municipality to account for populations served by combined sewers.[3]

Census definitions data from the 1990 census was used to identify urban populations of potential Phase II municipal separate storm sewer systems. The Bureau of the Census organizes population information according to political and demographic factors. Political jurisdictions include entities with governmental structures, such as States, counties, incorporated places (e.g., cities, towns, villages), and minor civil divisions (MCDs), which include towns and townships in 20 States. Table 2-1 summarizes the definitions of these political entities.

Table 2-1. Bureau of the Census Definitions of Municipal Entities

Incorporated Places—Places incorporated under the laws of their States as cities, boroughs, towns, and villages, with the following exceptions: boroughs in Alaska and New York, and towns in the six New England States, New York, and Wisconsin.
Minor Civil Divisions—Minor civil divisions are primary divisions of counties established under State law in 20 States. Townships are minor civil divisions in 12 States (Illinois, Indiana, Kansas, Michigan, Minnesota, Missouri, Nebraska, New Jersey, North Dakota, Ohio, Pennsylvania, and South Dakota). Towns are recognized as minor civil divisions in eight States (Connecticut, Maine, Massachusetts, New Hampshire, New York, Rhode Island, Vermont, and Wisconsin).
Counties—In most States, the primary divisions are termed counties. In Louisiana, these divisions are known as parishes. In Alaska, which has no counties, the county equivalents are the organized boroughs. In four States (Maryland, Missouri, Nevada, and Virginia), there are one or more cities that are independent of any county organization and thus constitute primary divisions of their States.

Source: Census of Population and Housing, 1990.

[3] See 40 *CFR* 122.26(f)(3). Combined sewers are conveyances that are designed to collect and convey both storm water and sanitary sewage. Combined sewers are not regulated under the storm water permitting program because they are regulated as part of the total discharge from the combined system under the existing NPDES permit conditions for that system. Combined sewers are addressed in this report only as an adjustment factor used to estimate storm water flows from urban areas.

Two additional geographical classifications were evaluated in the report, urbanized areas designated by the Bureau of the Census and metropolitan areas (MAs) defined by the Office of Management and Budget (OMB). The definitions of these terms are summarized in Table 2-2. Census-designated urbanized areas are based primarily on demographics and represent densely settled areas of 50,000 or more people. OMB identifies metropolitan areas based on economics and social trends, in addition to population densities. Metropolitan areas are defined based on county boundaries and are significantly more inclusive than urbanized areas, which more closely follow population distributions.

Table 2-2. Population Classifications of Bureau of the Census

URBANIZED AREAS—An urbanized area (UA) comprises an incorporated place and adjacent densely settled surrounding area that together have a minimum population of 50,000. The densely settled surrounding areas consists of:

1. Contiguous incorporated places or census designated places having:
   a. A population of 2,500 or more; or
   b. A population of fewer than 2,500 but having either a population density of 1,000 persons per square mile, a closely settled area containing a minimum of 50 percent of the population, or a cluster of at least 100 housing units.

2. Contiguous unincorporated area which is connected by road and has a population density of at least 1,000 persons per square mile.

3. Other contiguous unincorporated area with a density of less than 1,000 per square mile, provided that it:
   a. Eliminates an enclave of less than 5 square miles which is surrounded by built-up area.
   b. Closes an indentation in the boundary of the densely settled area that is no more than 1 mile across the open end and encompasses no more than 5 square miles.
   c. Links an outlying area of qualifying density, provided that the outlying area is:
      (1) Connected by road to, and is not more than 1.5 miles from, the main body of the UA.
      (2) Separated from the main body of the UA by water or other undevelopable area, is connected by road to the main body of the UA, and is not more than 5 miles from the main body of the UA.

4. Large concentrations of nonresidential urban area (such as industrial parks, office area, and major airports) which have at least one-quarter of their boundary contiguous to a UA.

URBAN POPULATIONS—All persons living in urbanized areas and in places of 2,500 or more inhabitants outside of urbanized areas. The urban population consists of all persons living in (1) places of 2,500 or more inhabitants incorporated as cities, villages, boroughs (except in Alaska and New York), and towns (except in the New England States, New York, and Wisconsin), but excluding those persons living in the rural portions of extended cities; (2) census designated places of 2,500 or more inhabitants; and (3) other territory, incorporated or unincorporated, included in urbanized areas.

RURAL POPULATIONS—Population not classified as urban.

The following information was obtained from the 1990 census data (Summary Tape File-1A) for all parts of the United States[4]:

- State and County location
- Population
- Land Area
- Population Density
- Growth Projections.

Information on urbanized areas, urban populations, and metropolitan areas was obtained from documents published by the Census Bureau.

2.2.1.2 Identification of Phase I and Phase II Municipalities

The following steps were taken to identify municipalities with Phase I municipal separate storm sewer systems:

- **Cities Specifically Identified in Phase I Regulations:** Based on the 1980 census, 173 cities were originally identified as having populations exceeding 100,000. Of these, a survey of authorized NPDES States and EPA Regions indicated that 30 cities with populations of 100,000 or more have been exempted from Phase I storm water requirements due to populations served by combined sewers. An additional 5 cities' populations dropped below 100,000 based on the 1990 census. Permit applications have not been required from these cities unless they have been designated for inclusion in Phase I by EPA or a State. For the purposes of this report, 140 of the 173 cities identified in the Phase I regulations are considered to be Phase I.

- **Counties Specifically Identified in Phase I Regulations:** Based on the 1980 census, 47 counties were originally identified as having populations in urbanized, unincorporated areas that exceeded 100,000 after the population in the incorporated places, townships, or towns was excluded. Incorporated places with a population of less than 100,000 that were located in these counties were treated as potential Phase II municipalities unless they were identified as being designated into Phase I by an authorized NPDES State or EPA Region. The population of 2 of these counties had

[4] Information obtained for Guam, the Virgin Islands, American Samoa, and the Commonwealth of the Northern Mariana Islands was limited to population and growth projections. For the Commonwealth of Puerto Rico and the District of Columbia, all information described above was obtained and used in the analysis.

dropped below 100,000 based on the 1990 census, leaving 45 Phase I counties specifically identified in Phase I regulations for the purposes of this report.

- **Municipalities Designated by NPDES Authorities:** Authorized NPDES States and EPA Regions have the authority to designate additional municipalities as subject to Phase I. A survey of authorized NPDES States and EPA Regions was used to identify designated municipalities. This report identifies designations that occurred before January 1994 and considers them to be Phase I sources for the purposes of this analysis.

All remaining municipalities with urban populations not identified as a part of Phase I of the NPDES storm water program were considered to be potential Phase II sources. Chapter 3 provides the specific numbers of municipal entities in various categories. Municipalities were differentiated based on characteristics such as size, density, or association with other levels and types of geographical and political jurisdictions. The designation of municipalities as Phase I vs. Phase II in this report is based on a "snapshot" of currently regulated municipalities as of January 1994.

2.2.2 Determining the Nature and Extent of Pollutants Associated With Municipal Separate Storm Sewer Systems

A review of the literature on urban runoff, including past studies conducted by EPA and the USGS, was used to develop a general descriptive profile of the nature of discharges from municipal separate storm sewer systems. Section 2.4 discusses this review.

Estimates of loads were developed for selected pollutants in runoff from urbanized areas. The approach used to estimate loadings of pollutants associated with discharges from municipal separate storm sewer systems was based on existing data and follows standard engineering practice (McCuen, 1989; American Society of Civil Engineers, 1969).

These estimates were developed to provide an overview of the extent of pollutant discharges associated with urban runoff and a relative ranking of the pollution potential from urbanized areas. The results can be used to compare potential Phase II municipal systems in

urbanized areas with Phase I municipal systems. This approach was not designed to estimate actual loads for any specific locality.[5] Thus, it would not be appropriate to use load estimates generated as part of this study in assessing potential storm water impacts within a specific receiving water body.

To estimate pollutant loadings from municipal separate storm sewer systems, the following equation was used for each pollutant of concern and for each urbanized area:

Load = Pollutant Concentration × Land Area × Rainfall × Runoff Coefficient × Conversion Factor,

where:

Load = Storm water pollutant load in thousands of pounds per year[6]

Concentration = Mean pollutant concentrations determined from NURP (mg/l)

Area = Land area for the urban site or place from the U.S. census (square miles)

Rainfall = Average annual rainfall, based on rainfall zone (inches per year)

Runoff Coefficient = A fraction that represents the proportion of rainfall that runs off the land to surface waters. It is related to the amount of land covered by impervious surfaces, such as roads and buildings

Conversion Factor = Adjusts units into pounds per year.

2.2.2.1 Pollutant Concentrations

A review of the literature showed that data from NURP (EPA, 1983) are the most frequently cited and often used reference values for urban runoff pollutant concentrations. NURP data were used as the basis for loadings calculations for this study after evaluating the procedures used in NURP and comparing the results with other independent studies of urban runoff undertaken by USGS.

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[5] In particular, rainfall and concentration data were not site-specific.

[6] The units of the final loading estimate were converted to thousands of pounds per year so that the results could be simplified.

NURP, which was conducted during the early 1980s, remains the most comprehensive assessment of pollutants in runoff from residential and commercial areas. The program was developed in the late 1970s, after EPA reviewed State 208 Water Quality Management Plan Reports and determined that additional and consistent data were needed to describe pollutants in urban runoff.

Under NURP, EPA provided direction and assistance to 28 planning projects located throughout the United States (Figure 2-1) that were selected from 93 area-wide agencies that had identified urban runoff as a potentially significant problem. (Table 2-3 lists the 28 NURP project locations according to EPA Regions.) Each project was separate and distinct but shared the common goal of conducting field monitoring to characterize pollutants in runoff from residential and commercial areas. The sampling locations within the 28 NURP projects included 81 specific sites and more than 2,300 separate storm events. The resulting data base represented a cross section of regional climatology, residential and commercial land use types, slopes, and soil conditions and, thereby, provided a basis for identifying patterns of similarities or differences and testing their significance.

Table 2-3. NURP Project Locations

EPA Region	NURP Code	Project Name/Location	EPA Region	NURP Code	Project Name/Location
I	MA1	Lake Quinsigamind (Boston Area)	V	IL1	Champaign-Urbana, Illinois
	MA2	Upper Mystic (Boston Area)		IL2	Lake Ellyn (Chicago Area)
	NH1	Durham, New Hampshire		MI1	Lansing, Michigan
				MI2	SEMCOG (Detroit Area)
II	NY1	Long Island (Nassau and Suffolk Counties)		MI3	Ann Arbor, Michigan
				WI1	Milwaukee, Wisconsin
	NY2	Lake George	VI	AR1	Little Rock, Arkansas
	NY3	Irondequoit Bay (Rochester Area)		TX1	Austin, Texas
			VII	KS1	Kansas City
III	DC1	WASHCOG (D.C. Metropolitan Area)	VIII	CO1	Denver, Colorado
	MD1	Baltimore, Maryland		SD1	Rapid City, South Dakota
				UT1	Salt Lake City, Utah
IV	FL1	Tampa, Florida	IX	CA1	Coyote Creek (San Francisco Area)
	NC1	Winston-Salem, North Carolina		CA2	Fresno, California
	SC1	Myrtle Beach, South Carolina	X	OR1	Springfield-Eugene, Oregon
	TN1	Knoxville, Tennessee		WA1	Bellevue (Seattle Area))

Source: U.S. Environmental Protection Agency, 1983

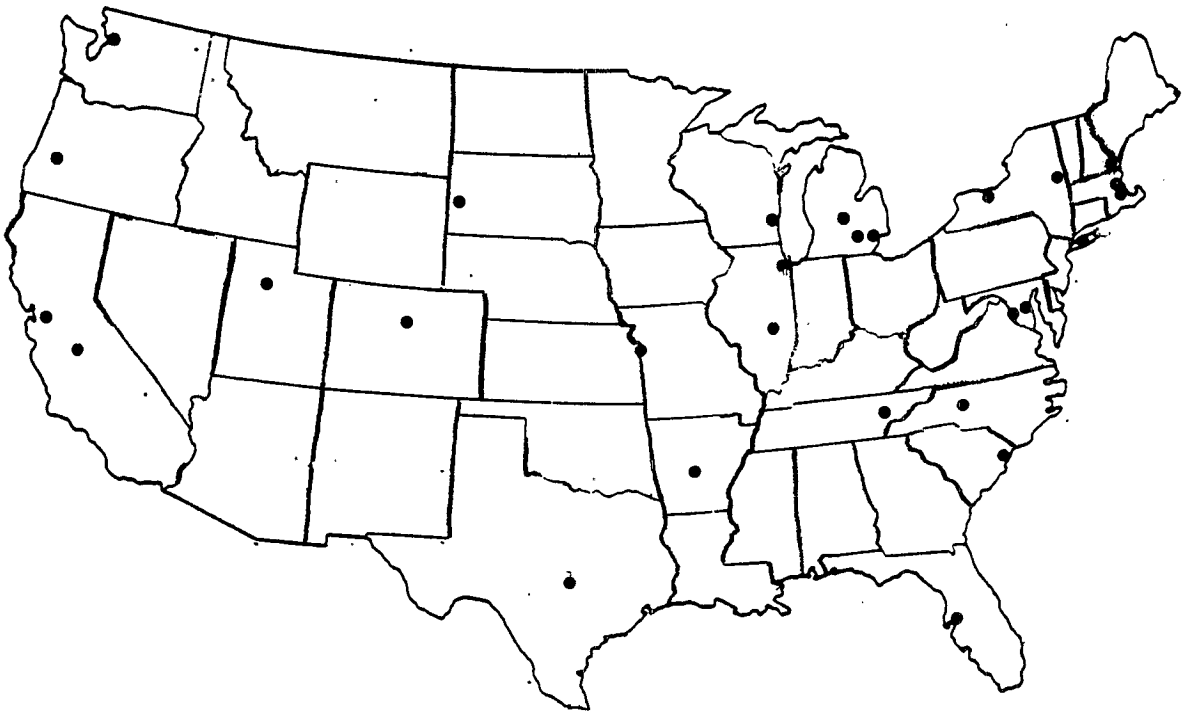


Figure 2-1. Location of NURP Sites

NURP focused on the following ten constituents, which were considered standard pollutants characterizing urban runoff:

- Total Suspended Solids (TSS)
- Biochemical Oxygen Demand (BOD)
- Chemical Oxygen Demand (COD)
- Total phosphorus (TP)
- Soluble phosphorus (SP)
- Total Kjeldahl Nitrogen (TKN)
- Nitrate + nitrite (N)
- Total copper (Cu)
- Total lead (Pb)
- Total zinc (Zn).

These pollutants are commonly associated with urban runoff and are often targets of point and nonpoint source studies. In addition, some of these pollutants can be surrogates for larger categories of pollutants such as oxygen consuming constituents and nutrients. NURP also examined coliform bacteria and priority pollutants (other than oil and grease). However, these parameters were only evaluated for a subset of sites and were not the primary focus of the NURP study. Moreover, they were not presented in a summary fashion suitable for estimating loadings. Soluble phosphorus is not discussed in this report because it was not addressed in USGS results or NPDES permit applications for industrial facilities (addressed later in this chapter).

NURP attempted to characterize the nature of storm water from residential and commercial areas. The data summaries excluded monitoring sites that were downstream of storm water controls. Sites were selected to focus on runoff from residential areas (primarily low density) and to avoid heavy industrial areas. NURP commercial site results did not include heavy industrial sites but in several cases reflected industrial park type use. Sites were also selected so that there were no extraneous sources of pollutants in the storm water discharge, such as illicit connections to the storm sewers. In addition, unusually high pollutant concentrations were eliminated from the data base as being atypical of storm water discharges.

Because of its site selection approach, NURP results represent normal or baseline urban runoff conditions from residential and commercial areas, not actual urban conditions which could include heavy industrial activities which were avoided by NURP. Because the NURP sites represent average runoff conditions from a mix of residential, commercial, and industrial park sites, loading estimates based on the NURP concentrations (described earlier in this Chapter and in Chapter 3) will be influenced by loadings from some of the sources considered in the industrial and commercial analysis (see Section 2.3 and Chapter 4) that were located in the catchments monitored.

NURP showed that the concentrations of pollutants in urban runoff vary considerably from site to site. Concentrations at individual sites also varied through the course of a storm event and between events. This variability is the natural result of variations in rainfall intensity, occurrence, and site-specific factors (e.g., slope, land use) that affect runoff quantity and quality. NURP data were summarized using average values for storm events, with an event mean concentration (EMC, i.e., the total pollutant mass discharged divided by the total runoff volume). To determine typical storm water concentrations, NURP researchers examined the data in various ways using standard statistical procedures, each exploring the effects of different factors (e.g., slope, land use category) on final concentration values. Based on these statistical tests, NURP concluded that geographic location, land use categories, or other factors appear to be of little utility in explaining the overall site-to-site variability, and the best general characterization of urban runoff is obtained by pooling the site data for all sites (except the open/non-urban ones). NURP recommended the total pollutant mass discharged divided by the total runoff volume (i.e., the event mean concentration [EMC]) as the best single measure for characterizing overall storm water pollutant concentrations. The data summarized from NURP are recommended for planning purposes rather than site-specific characterization. Table 2-4 presents summary statistics from NURP for different sites and results from other USGS studies, discussed below.

Comparison to USGS Urban Storm Water Data Base

In addition to EPA's efforts to characterize urban runoff, USGS has collected urban rainfall, runoff, and water quality data nationally for several decades. In the mid-1980s, much of this information was compiled into a national data base. This data base contains information on 717 storms at 99 stations in 22 metropolitan areas throughout the United States (Driver et al., 1985). The USGS examined a set of constituents similar to those used in NURP. The USGS also reported its data in terms of flow-weighted samples so that concentration and loading values could be compared directly to NURP results.

Table 2-4. NURP and USGS Summary Statistics— Water Quality Characteristics of Urban Runoff

		NURP (1983)				USGS (various years)					
		Median Urban Site (d)			Commercial	Residential		Commercial Sites		Industrial Sites	
		EMC Mean	EMC Median	90th%-ile	EMC Median	Mean	Median	Mean	Median	Mean	Median
Pollutant	units/notes	a	b	b	b	c	c	c	c	c	c
BOD5	mg/l	12	9	15	9	12	7	16	8	NR	NR
COD	mg/l	82	65	140	57	NR	NR	NR	NR	NR	NR
NO_2+NOL_3-N	mg/l	0.86	0.68	1.75	0.57	0.57	0.46	0.38	0.25	1.71	1.20
TKN	mg/l	1.90	1.50	3.30	1.18	NR	NR	NR	NR	NR	NR
Total P	mg/l	0.42	0.33	0.70	0.20	0.46	0.36	0.31	0.18	6.61	6.40
TSS	mg/l	180	100	300	69	1163	228	248	109	671	492
Copper	µg/l	43	34	93	29	43	20	28	16	89	74
Lead	µg/l	182	144	350	104	222	120	215	73	97	78
Zinc	µg/l	202	160	500	226	145	100	311	110	706	550

a - EMC mean reported on page 6-60 of NURP report in the context of loading estimate comparisons. EMC should be used when comparing cumulative effects such as WQ impacts in lakes or when comparing loads on a long-term basis.

b - EMC median reported on 6-43 of NURP as the best description of urban runoff characteristics in terms of water assessing short-term water quality impacts in rivers and streams.

c - Simple mean and median calculated from raw data from USGS. Because the data were not normally distributed, the median is the base measure of central tendency.

d - NURP's "median urban site" is a composite of land use types.

NR - Not Reported.

To provide a comparison to the NURP data for this study, the USGS data were analyzed statistically to develop mean and median pollutant concentration values for 7 of the 10 NURP pollutants. (The USGS data did not include COD, TKN, or soluble P. As previously noted, soluble phosphorus is not discussed in this report because it is not addressed in USGS or NPDES permit applications for industrial facilities.) To provide some perspective on NURP, different land use categories (i.e., residential, commercial, and industrial park sites) were analyzed separately. Table 2-4 summarizes the results from the USGS data base next to the NURP results. Although NURP results (for the median) are higher for BOD, nitrate + nitrite, copper, lead, and zinc, most of the results differ by less than 50 percent, except for TSS results, which are highly variable. Both sets of results are in the same range,

supporting the idea that these values are representative of the nature of urban runoff. This determination is consistent with the findings of Driver and Lystrom (1986), who also compared certain aspects of the two data sets.

As described in this chapter and in Chapter 3, this report uses historical data, generated by the Nationwide Urban Runoff Program (NURP) and by the U.S. Geological Survey (USGS), to generally and comparatively characterize metal contamination in storm water runoff from urban areas.

Recently, concerns have been raised regarding the validity and use of historical data for metals where adequate QA/QC cannot be properly documented (USGS, 1992). The quality of trace level metal data, especially at levels in the 1-5 part per billion (ppb) range, may be compromised due to contamination of samples during collection, preparation, storage, and analysis. These concerns have also been expressed as applying to the NURP metals data.

EPA believes that the metals data for urban runoff from USGS and NURP as used in this report are valid. Mean concentrations of copper, lead, and zinc observed under NURP and USGS were found to be in the range of 30 to 700 ppb (see Table 2-4), well above the 1-5 ppb range that has been identified as questionable. Furthermore, in dealing with the metals issue generally, EPA believes that most historical data for metals collected and analyzed with appropriate QA and QC at levels of 1 ppb or higher are reliable (EPA, 1993).

It should also be pointed out that the historical sampling data presented in this report is intended to provide a general, qualitative characterization of urban storm water runoff rather than a precise empirical relationship. The metals loadings estimated using NURP data are only used to illustrate relative loadings contributions from different geographical areas of the country. Quantitative loadings estimates, which could possibly be affected by suspect data, have not been presented in this report.

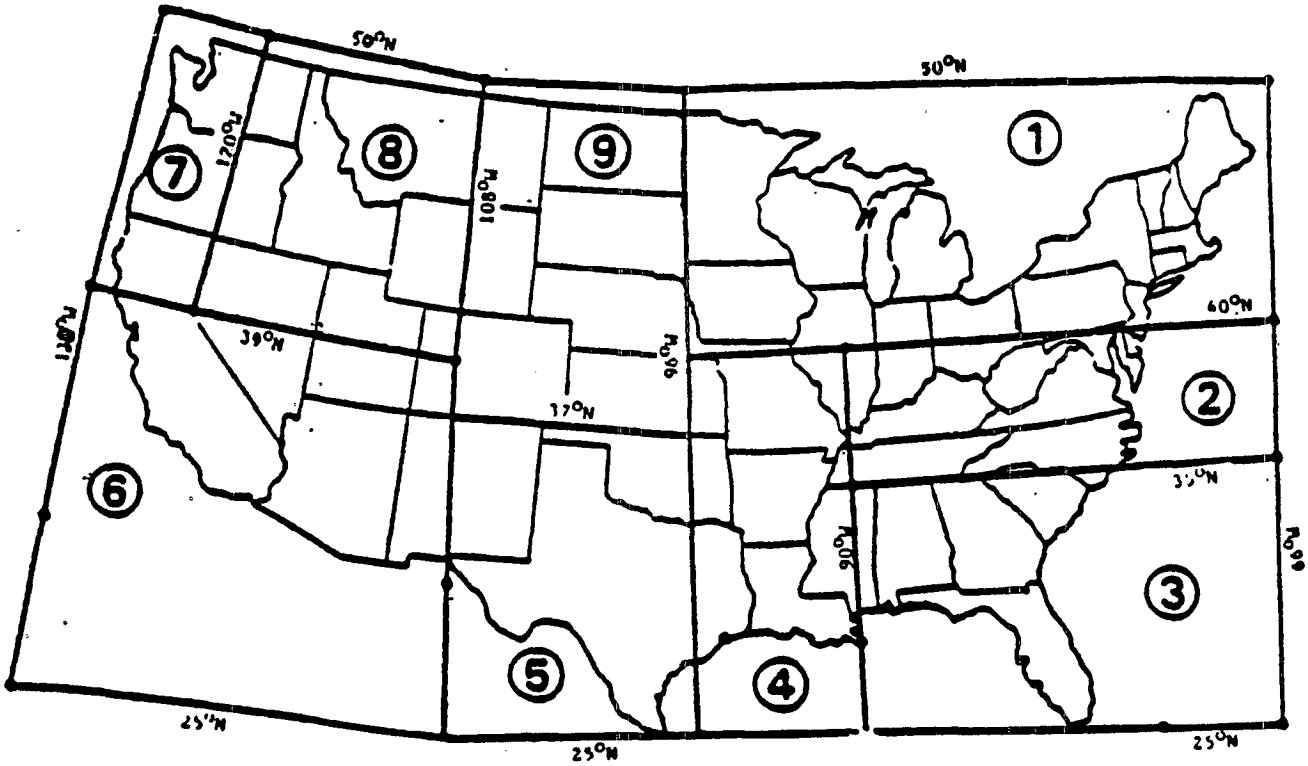
2.2.2.2 Land Area

Population and land area data (or population density) for all urbanized areas were obtained from the 1990 census. Phase I sources and potential Phase II sources were identified based on the procedure described in Section 2.2.1. An adjustment factor was developed to address combined sewer systems. Combined sewer systems are not considered to be part of the storm water regulatory program (although combined sewer overflows from combined sewer systems are addressed by the NPDES program). Therefore, storm water volume estimates in this report were adjusted to account for the flows entering combined sewers. Estimates of the land area served by combined sewer systems were based on data reported by the States for *The 1984 Needs Survey Report to Congress* (EPA, 1985).

2.2.2.3 Rainfall

Annual rainfall estimates were obtained from *Methodology for Analysis of Detention Basins for Control of Urban Runoff Quality* (Driscoll et al., 1986). This document identifies 9 rainfall zones in the United States (see Figure 2-2). Although these rainfall zones have been updated in *Analysis of Storm Event Characteristics for Selected Rainfall Gauges Throughout the United States* (Driscoll et al., 1989), (see Appendix B of this report) to include 15 more precisely defined rainfall zones, the 9 rainfall zones from the earlier report were used to simplify estimation procedures.

For each of the 3,141 counties in the country, the appropriate rainfall zone was identified, along with the average annual rainfall for that zone. This information was merged with the larger census data base at the county level to provide rainfall estimates for each municipality.



Not Shown: Alaska (Zone 7); Hawaii (Zone 7); Northern Mariana Islands (Zone 7); Guam (Zone 7); American Samoa (Zone 7); Puerto Rico (Zone 3); Virgin Islands (Zone 3).

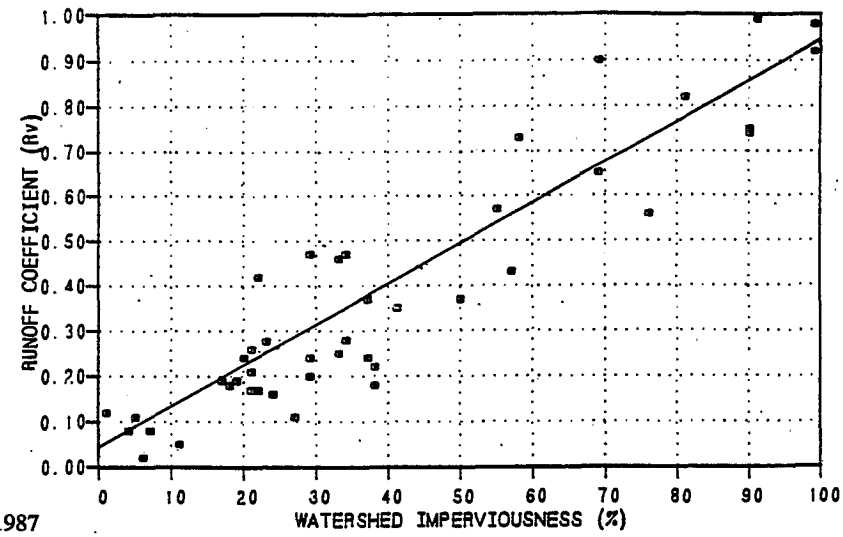
Zone 1	33.1	Zone 4	41.2	Zone 7	23.0
Zone 2	39.6	Zone 5	19.2	Zone 8	11.0
Zone 3	50.9	Zone 6	7.5	Zone 9	14.3

Source: 55 *FR* 47990, 1990
EPA, 1990

Figure 2-2. National Distribution of Rainfall Zones and Average Annual Precipitation (inches/year)

2.2.2.4 Runoff Coefficient

The runoff coefficient represents the portion (percentage) of total precipitation reaching the ground that becomes runoff to surface waters. A number of factors, such as the nature of the soils, topography, and amount or type of vegetative cover, can affect the runoff coefficient. However, the most important factor in determining the quantity of runoff from a given storm in a given area is the amount of impervious area (MWCOG, 1987). Impervious areas include all types of paved areas (e.g., streets, sidewalks, parking lots, driveways), buildings, roof tops, and other similar structures. The extent of impervious area is a function of many local considerations, such as the density and type of development. Generally, the runoff coefficient is directly related to watershed imperviousness, as illustrated in Figure 2-3, which contains data from 44 small urban catchments monitored during the national NURP study.



Source: MWCOG, 1987

NOTE: 44 small urban catchments monitored during the national NURP study.

Figure 2-3. Relationship of Watershed Imperviousness to Runoff Coefficient

The runoff coefficient used in the analysis of this report was estimated as a function of population density, based on equations that are widely used in the engineering literature, in previous studies by EPA's Office of Research and Development, and in the Corps of Engineers' Storage, Treatment, Overflow and Runoff Model (STORM) (which was designed

for planning purposes and simulation of storm events [Heaney et al., 1977]). The two equations are:

$$\text{Impervious Proportion} = 0.096 \times \text{population density}^{(0.573 - .0391 \times \log(\text{Population Density}))}$$
$$\text{Runoff Coefficient} = 0.15\ (1 - \text{impervious proportion}) + 0.90\ (\text{impervious proportion}).$$

Combining the two equations yields:

$$\text{Runoff Coefficient} = 0.15 + 0.75 \times [0.096 \times \text{population density}^{(0.573 - .0391 \times \log(\text{Population Density}))}]$$
where population density is in persons per acre.

The first equation estimates the site-specific level of imperviousness from population density. This empirical equation is based on data from another study of hundreds of municipalities in New Jersey (Stankowski, 1974). The second equation estimates a runoff coefficient from an empirical equation that depends on the level of imperviousness. Using this model, an area with no impervious surfaces would be assigned a runoff coefficient of 0.15, while a completely impervious area would have a runoff coefficient of 0.90. These equations produce results that are similar to those presented in Figure 2-3.

The model can be used to estimate runoff coefficients when only population density is known. Figure 2-4 shows how the model predicts the relationship between population density, expressed in persons per acre and the runoff coefficient. For example, for an urban area with 10 people per acre (or 6,400 people per square mile), the model estimates a runoff coefficient of 0.4, meaning that, on average, 40 percent of the rainfall runs off to surface water. The model estimates that places with higher population densities will have higher runoff coefficients. Although limitations are associated with this relationship (e.g., the original equation is based on land use conditions in the 1960s and the estimates are limited by the uncertainty of the assumed variables), the model can make use of population density data from the 1990 census in estimating runoff coefficients for different municipalities for comparative purposes.

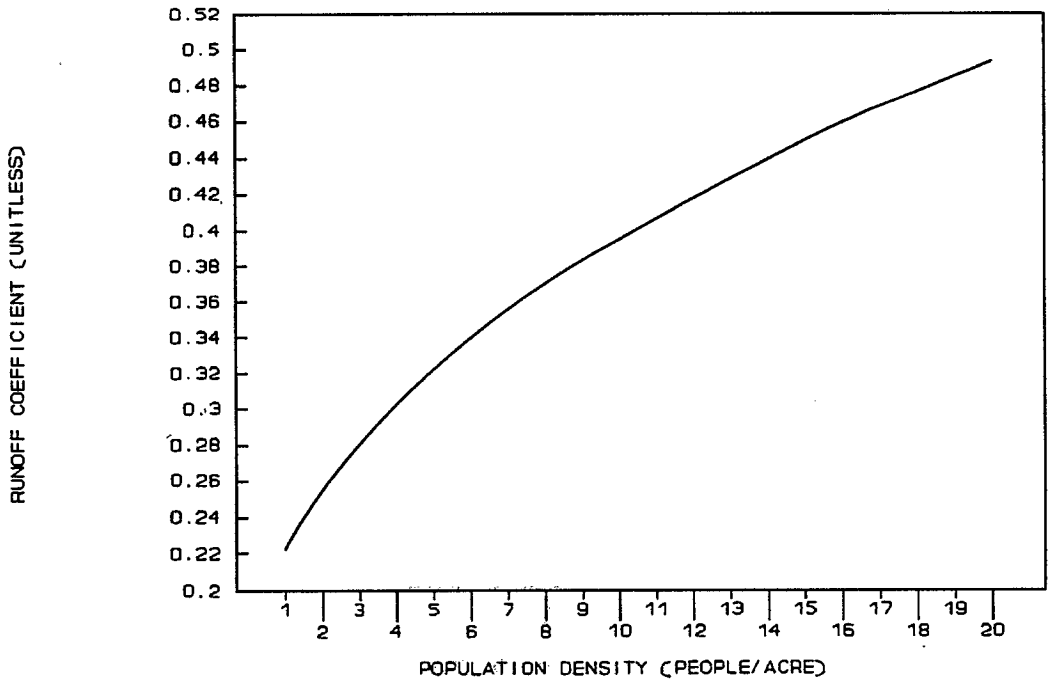


Figure 2-4. Runoff Coefficient Calculated as a Function of Population Density

2.3 ANALYSIS OF INDIVIDUAL PHASE II DISCHARGES

The second major focus of this study was to (1) identify types of industrial, commercial, and institutional storm water discharges for which permits are not already required as part of Phase I and (2) determine, to the maximum extent practical, the nature and extent of pollutants in such discharges. This section explains the approach used to select classes of facilities for study and the data analyses undertaken to develop the information presented in Chapter 4.

To develop information on remaining unregulated sources, sources regulated under Phase I were clearly defined and eliminated from consideration along with sources that have been statutorily exempted from both Phase I and Phase II. Then, from the remaining set of

sources and facilities, classes of facilities with the potential to contribute pollutants to storm water discharges were identified. The analysis of the nature and extent of individual Phase II discharges addresses both pollutant concentrations and the geographic distribution of facilities. The geographical analysis was developed to determine the distribution and location of individual Phase II facilities in relation to Urbanized Areas and the Phase II municipalities identified in the first part of this study. Although there was not enough data available on a national basis to estimate pollutant loadings from individual Phase II sources, the approach taken could later be related to an assessment of water quality conditions at the local, regional, or State level.

2.3.1 Identifying Individual Phase II Storm Water Discharges

The storm water discharge regulations (Phase I) require permit applications from facilities with "storm water discharges associated with industrial activity," as defined in 40 *CFR* 122.26(b)(14) (55 *FR* 47990). This definition describes the 11 specific categories of industrial activities which are regulated. For the categories of industries identified, the term includes storm water discharges from:

> . . . industrial plant yards; immediate access roads and rail lines used or created by the facility; material handling sites; refuse sites; sites used for the application or disposal of process waste waters . . .; sites used for the storage and maintenance of material handling equipment; sites used for residual treatment, storage or disposal; shipping and receiving areas; manufacturing buildings; storage areas (including tank farms) for raw materials, and intermediate and finished products; and areas where industrial activity has taken place in the past and significant materials remain and are exposed to storm water [40 *CFR* 122.26(b)(14)].

The definitions of the 11 categories include both narrative descriptions of activities and specific designations of industrial operations based on Standard Industrial Classification (SIC) code.[7] For example, category (i) mentions facilities subject to effluent limitations guidelines

[7] The SIC code is the statistical classification standard underlying all Federal economic statistics classified by industry (OMB, 1987).

developed by EPA, while category (xi) designates many specific SIC codes. Because of the comprehensiveness of the SIC system, even narrative descriptions can be correlated with SIC designations. For example, category (vii) covers steam electric power generating facilities, which are included primarily in SIC 4911, and category (ix) covers domestic treatment works, which are included primarily in SIC 4952. The practical effect of these narrative definitions and specific SIC code designations is that most of the industrial facilities subject to permit application requirements are represented by major SIC groupings 10 through 45.[8]

As a basis for identifying Phase II facilities and obtaining information about their distribution and abundance, this study focused on SIC codes. Major sectors of the economy are defined on the basis of the two-digit SIC code group. The two-digit code is a relatively general categorization of the Nation's economic activity; all industrial, commercial, and retail activities are organized into less than 100 two-digit SIC codes, which are listed in Table 2-5. The more specific four-digit SIC code provides a more detailed breakdown of these enterprises and is much more descriptive of the activities conducted at the establishment. The SIC code identifies facilities based on the "primary activity" in which a facility is engaged. Chapter 4 discusses selected advantages and disadvantages of using the SIC code system for identification of storm water sources. Focusing on SIC codes for the purposes of this study does not imply that EPA must regulate on a SIC code basis. Also, although some potential Phase II categories or concerns may be defined or discussed in terms of narrative descriptions, these can be evaluated in terms of SIC code designations.

Although all unregulated facilities which have point source discharges of storm water are potential Phase II sources, in practical terms, only a subset of four-digit SIC codes have real

[8] The NPDES regulations specifically exempt some categories of activity from the definition of point source, including storm water runoff from agricultural sources and silviculture activities (mostly in SIC codes 01 through 09) (40 *CFR* Part 122.3(e)), irrigation return flows (40 *CFR* Part 122.3(f)), and uncontaminated runoff from mining sites and oil and gas facilities (40 *CFR* 122.26(a)(2)). In addition, construction activities are regulated based on the site where activity is occurring, not based on the SIC code for contractors and builders that may participate in the construction (SIC 15 - 17).

Table 2-5. List of All Two-Digit SIC Code Groups and Industry Description

SIC CODE	DESCRIPTION	SIC CODE	DESCRIPTION
01	Ag. Product.-Crops	50	Wholesale-Durables
02	Ag. Product.-Livestock	51	Wholesale-Nondurables
07	Ag. Services	52	Bldg. & Gard. Mats.
08	Forestry	53	General Stores
09	Fishing, Hunting	54	Food Stores
10	Metal Mining	55	Auto Dealers & Service
12	Coal & Lignite Mining	56	Apparel Stores
13	Oil & Gas Extraction	57	Furniture Stores
14	Nonmetallic Minerals	58	Eat & Drink Places
15	Building Contractors	59	Misc. Retail
16	Heavy Const. Contractors	60	Banking
17	Spec. Trade Contractors	61	Credit Agencies
20	Man. Food, etc.	62	Security Brokers
21	Man. Tobacco	63	Insurance Carriers
22	Man. Textile	64	Insurance Agents
23	Man. Apparel	65	Real Estate
24	Lumber & Wood	67	Investment Offices
25	Furniture & Fixtures	70	Hotels & Lodging
26	Paper & Allied Prod.	72	Personal Services
27	Printing & Publish.	73	Business Services
28	Chemicals & Allied	75	Auto Repair Services
29	Petroleum & Coal	76	Misc. Repair
30	Rubber & Plastic Products	78	Motion Pictures
31	Leather/Products	79	Amusement Services
32	Stone, Clay & Glass	80	Health Services
33	Primary Metal Ind.	81	Legal Services
34	Fab. Metal Products	82	Educational Services
35	Machinery-electric	83	Social Services
36	Electronic Equip.	84	Museums
37	Transportation Equip.	86	Membership Orgs.
38	Instrument & Related	87	Research & Development
39	Misc. Manufacturing	88	Households w/Employees
40	Railroad Transport	89	Services, NEC
41	Local Pass. Transit	91	Executive, Gen'l Govt.
42	Trucking	92	Justice, Public Order
43	U.S. Postal Service	93	Public Finance, Taxes
44	Water Transport	94	Human Resource Admin
45	Air Transport	95	Env. Qual. & Housing Admin.
46	Pipe Lines-Nat. Gas	96	Economic Program Admin.
47	Transport Services	97	National Security
48	Communication	99	Non-Classifiable
49	Electric, Gas & Sanitation		

potential to use, process, or store sources of pollutants, or engage in activities that could lead to contamination of storm water. In addition, there are many general sources of storm water contamination such as parking lots, trash dumpsters, and failing septic systems which could be associated with almost any commercial or residential activity. Some general information on these sources is presented in Chapter 4; however, the focus of this report is in identifying specific classes of facilities with greater than average potential for contribution of pollutants to storm water discharges based on their activities.

EPA identified two major groups of facilities for potential inclusion in Phase II. The first group of potential Phase II facilities identified (Group A) consists of facilities in the same SIC code groups as Phase I facilities (SICs 10-45) that are conducting activities that are essentially the same as Phase I industrial activities but that were not included in Phase I due to the specific language of the statute or EPA's regulatory specificity in defining the universe of Phase I industrial activities. The second major group (Group B) consists of facilities in all other SIC code groups where discharges of pollutants are suspected based on case studies, expert opinions, literature reviews, and other sources of information such as experience with Phase I of the storm water program.[9]

2.3.1.1 Group A Facilities

Group A is comprised of facilities which are generally identical to regulated Phase I industrial activities but that have been excluded from Phase I due to the specific language of the statute or EPA's regulatory specificity. While some of the facilities that make up Group A are obvious, (i.e., those with a specific statutory exemption from Phase I), others are more difficult to identify. Because these facilities may be described by SIC codes identical to Phase I regulated facilities, the FACTS data base was of little use in identifying these

[9] Although some sources similar to Phase I industrial activities were not identified in the 1990 application regulations (55 FR 47990) directly, EPA or an authorized NPDES State has the authority under Section 402(p)(2)(E) to designate individual facilities as needing an NPDES permit. Although some designations of this type have been made, this report bases the distinction of individual Phase I and Phase II facilities based on the regulatory definition and not on any individual designations which may have been made.

facilities. Instead, each of the 11 industrial categories that make up Phase I (see Chapter 4, Table 4-2) was examined for possible omissions and discrepancies. The result of this effort was a list of sources that are *not* covered under Phase I but that are closely related to one of the eleven categories of industrial activity. This list appears in Table 4-3. In order to help define these facilities, sources on the list were categorized into three major groups. Group A sources are described in Chapter 4.

2.3.1.2 Group B Facilities

The second general class of facilities were identified on the basis of potential activities and pollutants that may contribute to storm water contamination (Group B). Unlike Group A facilities which are generally represented by the same range of SIC code groups as Phase I facilities (SICs 10-45), Group B facilities have distinctly different SIC codes but may be performing similar activities or using similar materials as Phase I facilities. Based on the review and analysis of the types of industrial sources not covered under Phase I, several categories of Group B facilities were identified that have activities inherently similar to Phase I but are not currently regulated. Some SIC code groups were also identified using other criteria, described below.

Commercial facilities were specifically excluded from Phase I by Congress. However, many commercial sources represent an important environmental concern. These concerns are documented in State and local nonpoint source programs, urban runoff programs, and estuary programs identified through the literature review (see Section 2.4). The Rensselaerville Study (1992) reflected this view by identifying "gas, auto, service stations, transportation related activities, highway systems, land development, agricultural sources and related activities, commercial activities with industrial components, and large retail complexes" as sources of concern.[10]

[10] No SIC codes specifically identify all large retail complexes. However, these complexes are partially addressed through the loading analysis of storm water from urban/urbanized areas in the municipal section (Chapter 3).

Another class of facilities included in Group B is commercial agricultural-related activities. Categories that are specifically exempted from regulation under Section 402 of the CWA (or, in certain cases, under existing NPDES regulations) were eliminated from consideration in Group B as potential Phase II sources. (These include agriculture and most silviculture activities generally included in SIC code groups 01, 02, 07, 08, and 09.[11]) However, several specific SIC codes were retained on the list as potential Phase II sources because they are not specifically included under the agricultural exemption. These include nurseries, feedlots (the larger of which are already regulated under the NPDES permitting program),[12] some forestry operations, and miscellaneous others.[13]

A final review of other miscellaneous sources that have been identified as potential contributors to storm water pollution was conducted to reveal any sources not addressed by the criteria discussed above. The facilities identified use or handle materials containing pollutants of concern to publicly owned treatment works (POTWs). To the extent that these materials are used, stored, processed, or disposed of outdoors at Group B facilities, they may also represent a source of storm water contamination.

The procedure used to identify specific SIC codes with significant potential to discharge pollutants to storm water resulted in the identification of 90 categories of facilities. Table 4-4 lists the subset of 90 four-digit SIC codes identified from this analysis. The analysis was comprehensive and inclusive, while at the same time carefully determining whether a category had the potential to contribute pollution to storm water.

[11] The NPDES regulations at 40 *CFR* 122.27 cover discharges from certain types of silviculture activities but do not cover other discharges that are nonpoint in nature.

[12] Feedlots that are not contained within the regulatory definition of concentrated animal feeding operation (CAFO) are not point sources unless designated on a case-by-case basis under 40 *CFR* 122.23(c).

[13] Under 402(p)(6), EPA may establish regulations that could include sources that are not currently defined as point sources or examined as potential Phase II sources in this report, including some operations related to silviculture.

The geographic distribution analysis was completed for all major two-digit SIC code groups and for the 90 specific four-digit SIC codes identified in Table 4-4. Information about the distribution of all facilities is presented in the report, even for categories that are not among the 90 potential Phase II categories, including all Phase I facilities, financial and service groups, and agricultural activities.

2.3.1.3 Service Sectors

Major SIC code groups in the service sectors, such as banking, finance, insurance firms, and food services were not considered to be potential Phase II sources. The activities of these enterprises are generally conducted indoors and do not inherently use or produce contaminants that may enter storm water. Although these facilities may have general sources such as parking lots or trash dumpsters which could contaminate storm water discharges, the municipal analysis considers pollutant loadings from these types of sources. All of the major SIC groups excluded on this basis are listed in Table 4-6. Regardless, the geographic and distributional analysis was conducted for these facilities at the major group (two-digit SIC) level. These results are presented in Appendix G.

2.3.2 Determining the Nature and Extent of Pollutants Associated With Industrial and Commercial Discharges

The nature and extent of discharges from potential Phase II industrial and commercial discharges were analyzed in a manner that allows comparison with the municipal analysis in terms of geographic distribution. The potential pollutant content of storm water from industrial and commercial sites was characterized and the locations of these potential discharges were analyzed with respect to urbanized areas. The nature of discharges was evaluated by comparison to existing studies (i.e., NURP and USGS), by analysis of discharge data from Phase I sources, and by compilation of qualitative information from a literature survey. The geographic extent of discharges was evaluated by analyzing the location of facilities using the FACTS data base in conjunction with information from the census, as explained below.

2.3.2.1 Identifying Pollutants Associated With Industrial and Commercial Discharges

Storm water discharged from industrial, commercial, and retail facilities has the potential to come into contact with raw materials, products, and waste streams, which can result in pollutant contamination of storm water discharges. A number of general categories of activities and conditions that have the potential to generate contaminants in storm water have been identified in both the proposed and final NPDES Permit Application Regulations for Storm Water Discharges (53 *FR* 49416; 55 *FR* 47990):

- Outside loading of dry bulk or liquid materials that may be spilled or accumulated and washed with rainfall into storm sewers or receiving waters
- Outside storage of raw materials, wastes, or products
- Outside processing of materials where rainfall may come into contact with materials in the process stream
- Practices with the potential for spills to the storm sewer or wash down of processing areas to floor drains
- High volume water use in material processing
- Direct application of wastes to the ground
- Dust and particulate generating processes
- Vehicle and equipment maintenance activities.

Most of these activities are specifically mentioned in the definition of discharges associated with industrial activity (40 *CFR* 122.26(b)(14)).

To characterize potential industrial and commercial storm water discharges, data on industrial and commercial sites and land uses were taken from the NURP and USGS studies and analyzed statistically and presented for comparison purposes. Chapter 4 provides further comparison and discussion. The results provide general insight into the nature of storm water runoff from light industrial areas.

The nature of industry-specific storm water quality data was characterized by analyzing sampling data submitted by group permit applicants under Phase I. These sampling results provide insight into the nature of storm water from these industrial sites and storm water from potential Phase II facilities which may have similar characteristics.

This analysis focused on the pollutants that were required to be analyzed for in the Part II NPDES storm water permit group application plus copper, lead, and zinc. For each pollutant and each industrial sector, the mean, median, and 95th percentile were calculated for both grab and composite samples, where the pollutant was identified. Where applicants reported none detected, the result was treated as zero, an approach consistent with the analysis of data from Phase I industrial facilities as presented in Appendix F. Chapter 4 summarizes these data. Appendix F contains detailed data summaries for each of 29 industrial sectors developed for the group application process.

To facilitate characterization of the nature of discharges from potential Phase II sources, similarities between Phase I and Phase II facilities were highlighted by comparing categories with similar activities, where possible. For facilities in Group A, comparison to Phase I sectors is generally straightforward and yields valuable information about these potential Phase II facilities. For Group B facilities, the corresponding Phase I activity may not be as similar. Comparisons were made only in general terms at the industrial sector level and not at the level of specific SIC codes or facilities. The resulting information presented in Chapter 4, therefore, can only be used as a guide to the general types and levels of pollutants that may be found at facilities of a given category, rather than a definitive determination of the degree of contamination at a particular site. These results are presented in Chapter 4.

To supplement the Phase I data analysis, a literature review was conducted to locate and summarize the available information on the nature of pollutants with emphasis on the groups of categories selected by the screening procedure outlined above. The literature review focused on identifying the types of pollutants that may be associated with particular

categories of facilities. General qualitative information on storm water discharges and potential pollutants is available in the literature from a number of case studies and assessments of specific locations and types of facilities. Although providing useful background information, it is usually not comprehensive for any one category and may not be comparable across categories.

2.3.2.2 Determining the Extent of Individual Phase II Sources

The extent of storm water discharges from Phase II sources was determined by identifying the locations of the facilities in those categories, rather than the pollutant loads associated with them, as in the municipal analysis. Nation-wide information on the extent of pollutants from these facilities is limited. However, detailed quantitative information on the geographic extent and distribution of these facilities can be developed by combining two data sources[14]:

- FACTS provides data, including name and address, county affiliation, primary business activity (SIC), employment, and sales, on more than 7.7 million industrial, commercial, retail, and government facilities.
- The 1990 Census of Population and Housing, discussed previously, provides detailed information on population and area for most political subdivisions in the country. County-level information on population associated with urbanized areas was used in this analysis.

An analysis was conducted to determine the distribution of individual Phase II facilities and categories in relation to population patterns. To develop information comparable to the municipal analysis, the analysis of individual sources was conducted at the county level. This analysis was conducted to examine the distribution of industrial, commercial, and retail enterprises to determine how they are distributed relative to jurisdictions of potential interest in development of potential Phase II regulatory approaches.

[14] Information on number and location of facilities was limited to the 50 States and the District of Columbia. Analysis of these statistics in relation to urbanized areas was not performed for the facilities and urbanized areas in the Commonwealth of Puerto Rico.

The geographic analysis involved developing, for each county, population, and area, data for all the same political and geographic jurisdictions studied in the municipal analysis, based on the 1990 census data base. Jurisdictions of interest included urbanized areas and Phase I cities, as discussed in Section 2.2, for municipal discharges. For each county, then, the proportion of individual facilities within urbanized areas could be calculated, and the number of facilities located in Phase I and Phase II areas could be determined.

Because the facility location data was not available at the same level of detail as census data used in the municipal analysis, the next step of the procedure made use of the approximate correlation between the location of business and economic activity and the distribution of population. Specifically, the analysis relies on the premise that industrial and commercial facilities are distributed similarly to population within county jurisdictional boundaries. For example, the percentage of facilities estimated to be in the urbanized area of a county is allocated based on the percentage of population in the urbanized area of the county. The premise may be more valid for urban retail activities, such as automobile service activities, and less valid for agricultural activities, which are generally less likely to be associated with urban areas. However, when considering all counties together, as shown in Chapter 4, this procedure produces reasonable results, even for rural businesses, because they are more often located in counties with small urban populations.

Using FACTS, individual facilities were counted for each SIC code and for each county.[15] By basing the distribution of facilities on the distribution of population within a county, it was possible to allocate a portion of the facilities in each county to urbanized areas. The national total for each jurisdictional class was obtained by summing over all counties.

[15] A few facilities had incomplete records for county name and so could not be analyzed using this procedure. Given the intensive data collection activities of Dun & Bradstreet and the focus on economic activity for marketing purposes, the largest and most economically important facilities probably have the most complete records. Thus, the types of facilities with incomplete records are probably small and economically less significant.

2.4 LITERATURE REVIEW PROCESS

The literature review for information about storm water discharges, sources, and pollutants was fundamental to the approach. The following sections describe the activities conducted during the literature search.

2.4.1 Libraries

An extensive literature search was conducted at several libraries, including the University of Maryland and George Washington University, the Library of Congress, the USGS library, and the National Agricultural Library. The On-Line Computer Library Center (OCLC), a national bibliographic data base of 27 million records representing the holdings of more than 15,000 libraries worldwide, was accessed at the University of Maryland. Libraries that use OCLC primarily include public libraries, university libraries, and governmental agency libraries, such as the Department of Interior, Department of Agriculture, and the USGS. The system enables the user to search for periodicals, books, and other publications by using author, title, or subject key words. Numerous key words and phrases were searched, including key words associated with the activities of industries selected for the Phase II analysis. General terms such as storm water, industrial pollution, and names of products or contaminants thought to be associated with particular industries were also searched using OCLC.

At the Library of Congress, a data base search was conducted for information in trade association journals and other publications, environmental engineering journals and periodicals, environmental business journals and periodicals, and other publications that potentially have information related to the industrial analysis. Many of the trade association publications are only available to association members. For those publications found in library holdings, a search was conducted for articles that did not show up during the OCLC search. The data base used at the Library of Congress comprises numerous computerized disk files, each containing information on various subjects, such as science and engineering. The science and engineering disk (the most closely related topic area) was used to search for

periodicals available through local libraries. Back-issues of many of the more topical publications were scanned for information relevant to the industrial analysis. The majority of periodicals searched are included in the list given in Table 2-6. At each library, library-specific data bases were searched for documents located in the individual library but not entered into the OCLC data base.

Table 2-6. List of Periodicals and Journals Searched

Autoracing Digest	*Water/Engineering and Management*
Automotive Industries	*Waste Age*
Automotive Repair News	*Modern Casting*
Automotive Review	*Journal of Environmental Quality*
Automotive Week	*Journal of Water Pollution Control Federation*
Chemical Business	*Journal of Water Resource Planning and Management*
Chemical Industry Notes	*Journal of Transportation Engineering*
Chemical Engineering	*Journal of Irrigation and Drainage Engineering*
Chemical Marketing	*Science*
American Petroleum Institute's Annual Report	*Pipeline and Gas Journal*
Service Station Management	*American Industrial Hygiene Association Journal*
Petroleum Independent	*Pipe Line Industry*
Petroleum Marketer	*JAPCA*
Environmental Progress	*Material Handling Engineering*
Environmental Pollution	*Engineering News Record*
Environmental Research	*The Engineer*
Environmental Science and Technology	*Highway and Heavy Construction*
Water Research	*Plastics World*
Water Resources Bulletin	*ISA Transactions*
Water Resources Research	*Chemical and Engineering News*
Oil and Gas Journal	*Biocycle*
Water Science and Technology	*The Management of World Wastes*
Pollution Engineering	*Metal Finishing*
Journal of Testing and Evaluation	
Successful Farming	
Plant Engineering	

2.4.2 Additional Resources

Other resources used in the literature search included EPA documents and periodicals in the Pollution Prevention Information Clearinghouse and Toxic Release Information System, documents available through EPA, EPA's docket, topic-related development documents and

effluent guidelines limitations, and publications from State offices related to potential Phase II industries. Additional organizations and individuals were contacted to obtain information on pollutant concentrations in storm water discharges from industrial facilities, especially potential Phase II sources. Only a few documents obtained contained industry-specific pollutant concentration data. The rest provided background information on potential Phase II sources. Organizations contacted specifically for information include the U.S. Department of Defense, the number and a list of military bases; the U.S. Department of Transportation, for an estimate on the acreage or miles of road disturbed per year; the Forest Service at the U.S. Department of Agriculture, for data on storm water discharges from the construction of roads for logging and related activities; and the National Estuary Program, to ascertain data on storm water impacts outlined in estuary management programs.

A list of the documents obtained from the various sources mentioned above is included in the bibliography at the end of this report. Other documents available in the EPA docket (Record For Proposed NPDES Storm Water Implementation Package) were also reviewed.

2.4.3 Potential for Obtaining Additional Information

Based on research efforts for the Report to Congress, quantitative information on pollutant concentrations (and loadings) from industrial activities, especially potential Phase II (unregulated) categories, is limited. EPA's literature search for information on industrial sources identified many major categories of information. Pursuing additional sources of information and extending the literature review effort would probably yield more qualitative information to enhance the existing information on industrial sources. In particular, information on the processes and activities associated with the facilities and a better idea of the types of pollutants involved could potentially be documented. By focusing on particular industry sectors, it may be possible to get more information on the number and size of facilities, as well as information on quantities of products mined, distributed, etc.

CHAPTER 3. MUNICIPAL SEPARATE STORM SEWER SYSTEMS

Section 402(p)(2) of the Clean Water Act (CWA) requires the control of discharges from municipal separate storm sewer systems serving a population of 100,000 or more under Phase I of the NPDES storm water program. This chapter identifies municipal separate storm sewer systems not identified in Phase I that potentially may be subject to requirements under Phase II of the NPDES storm water program. In addition, this chapter describes the nature and extent of pollutants associated with municipal separate storm sewer systems, with an emphasis on potential Phase II sources. To provide an appropriate context for the discussion of potential Phase II sources, this chapter also discusses Phase I municipal systems.

Municipal separate storm sewer systems are comprised of conveyances designed to collect and convey storm water (but not sanitary sewage[1]) that are owned or operated by a municipality. Section 402(p)(3) of the CWA authorizes EPA and NPDES States to issue system-wide or jurisdiction-wide permits for discharges from municipal separate storm sewer systems. NPDES permits for discharges from municipal separate storm sewer systems are to contain requirements to reduce the discharge of pollutants to the maximum extent practicable (MEP) and to effectively prohibit non-storm water discharges to the municipal system in order to meet water quality standards. These requirements can be implemented through municipal storm water management programs to control pollutants from targeted commercial, residential, industrial, and other sources that discharge storm water (or other non-storm water discharges) through the municipal system.

3.1 IDENTIFICATION OF MUNICIPAL SEPARATE STORM SEWER SYSTEMS

The Bureau of the Census estimates that the population of the United States and associated territories was more than 252.2 million in 1990.[2] There are 19,289 incorporated

[1] Combined sewers are conveyances designed to collect and convey both storm water and sanitary sewage. This report generally does not address combined sewers.

[2] Population estimates based on the 50 states, the District of Columbia, Guam, the Commonwealth of Puerto Rico, the Virgin Islands, American Samoa, and the Commonwealth of the Northern Mariana Islands.

places and 17,796 minor civil divisions in the continental United States, Alaska, and Hawaii. These incorporated places and minor civil divisions are located in 3,141 counties or county equivalents. As discussed in Chapter 2, Table 2-2 provides the Bureau of the Census definitions for the major forms of municipal government.

3.1.1 Population Distributions

The Bureau of the Census defines two classes of population: urban and rural. The majority of the population in the United States is classified as urban (188 million or 75 percent of the total U.S. population), with only 25 percent of the population classified as rural.

3.1.1.1 Urbanized Areas

To provide a better separation of urban and rural population and housing in the vicinity of large cities, the Bureau of the Census defines an urbanized area as a central city (or cities) with a surrounding area that is densely settled (i.e., urban fringe). The population of the entire urbanized area must be greater than 50,000 persons, and the urban fringe must have a population density generally greater than 1,000 persons per square mile (just over 1.5 persons per acre). As discussed in Chapter 2, Table 2-2 provides the definitions of urban populations, rural populations, and urbanized areas used in the 1990 census.

The Bureau of the Census identified 405 urbanized areas of 50,000 or more people based on the 1990 census. The combined population of these areas was more than 160 million people (63 percent of the total U.S. population and 85 percent of the urban population). However, these areas occupy less than 2 percent of the Nation's total land area. Figure 3-1 shows the location of the 405 urbanized areas.

Table 3-1 gives the number of urbanized areas in different size classes. Table 3-2 provides the distribution of urbanized populations and municipalities by State.

Table 3-1. Size Distribution of Urbanized Areas in 1990

Urbanized Area Population Range	Number of Urbanized Areas	Total Population	Total Area (sq.mi.)	Average Area (sq.mi.)	Average Population Density (pop./sq.mi.)
Over 1,000,000	34	95,237,380	27,749	816	3,432
500,000 - 999,999	26	17,955,916	8,122	312	2,211
250,000 - 499,999	44	15,470,005	7,732	176	2,001
150,000 - 249,999	62	11,945,413	5,877	95	2,033
100,000 - 149,999	63	7,538,363	4,366	69	1,727
75,000 - 99,999	58	5,045,917	3,058	53	1,650
60,000 - 74,999	55	3,705,855	2,375	43	1,560
50,000 - 59,999	63	3,485,284	2,241	36	1,555
TOTALS	405	160,384,133	61,520		

Source: *1990 Census of Population and Housing*, Bureau of the Census, U.S. Dept. of Commerce

3.1.1.2 Metropolitan Areas

The Office of Management and Budget (OMB) identifies metropolitan areas based on economic and social trends, as well as population densities. The general concept of a metropolitan area is one of a large population nucleus, together with adjacent communities which have a high degree of economic and social integration. Metropolitan areas have a total population of 100,000 or more (75,000 in New England) and contain either a place with a population of 50,000 or more or an urbanized area of 50,000 or more. A metropolitan area is comprised of one or more central counties and outlying counties that have close economic and social relationships with the central county. Unlike a Census-designated urbanized area with boundaries that follow population patterns, the boundaries of a metropolitan area follow county boundaries[3] and can contain significant tracts of rural land.

[3] In New England, metropolitan areas follow town boundaries.

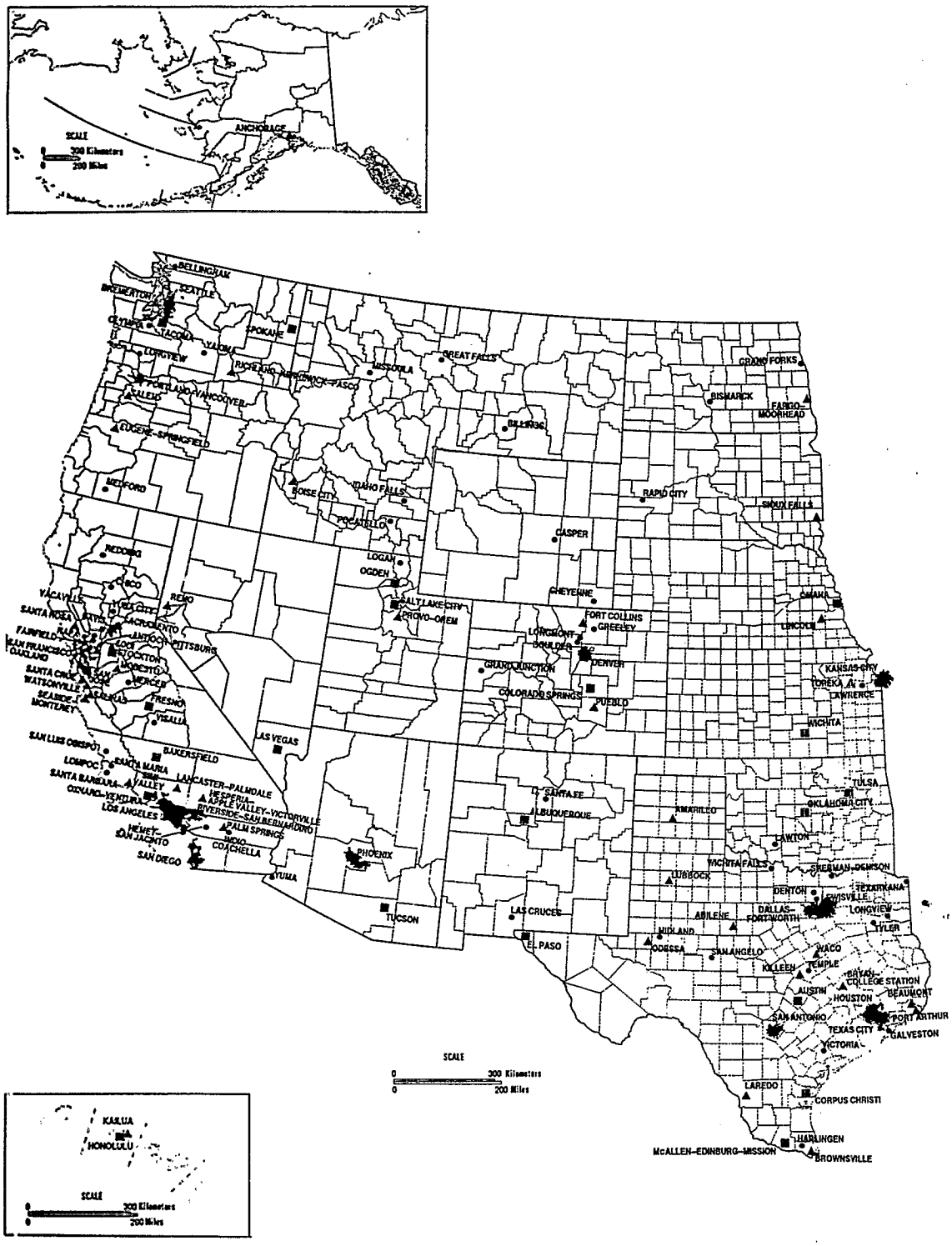
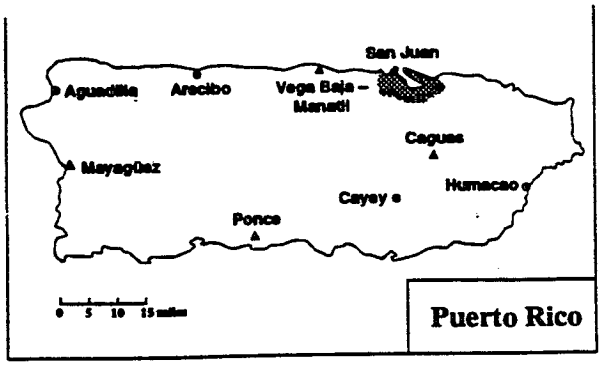


Figure 3-1. Urbanized Areas of the United States



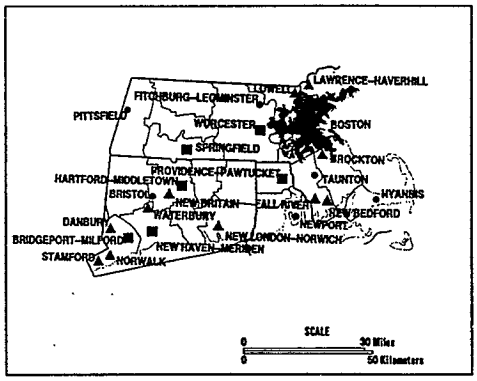


Figure 3-1. Urbanized Areas of the United States (continued)

Table 3-2. Populations in Urbanized Areas

State	Urbanized Area Population	Number of Urbanized Areas
Alaska	221,883	1
Alabama	1,839,966	12
Arkansas	591,420	6
Arizona	2,655,997	3
California	25,466,131	38
Colorado	2,377,820	8
Connecticut	2,455,697	12
District of Columbia	606,900	1
Delaware	458,749	2
Florida	10,177,624	27
Georgia	3,260,674	11
Hawaii	747,109	2
Iowa	942,653	8
Idaho	278,200	3
Illinois	8,478,687	18
Indiana	2,692,676	13
Kansas	1,018,604	5
Kentucky	1,276,855	7
Louisiana	2,228,018	9
Massachusetts	4,730,382	13
Maryland	3,581,461	7
Maine	266,732	4
Michigan	5,812,473	16
Minnesota	2,370,935	7
Missouri	2,782,738	6
Mississippi	617,412	5
Montana	208,883	3
North Carolina	2,512,866	17
North Dakota	202,334	3
Nebraska	687,875	3
New Hampshire	339,454	5
New Jersey	6,629,540	7
New Mexico	649,793	4
Nevada	911,095	2
New York	14,116,042	14
Ohio	6,656,974	20
Oklahoma	1,354,343	4
Oregon	1,420,059	5
Pennsylvania	7,207,497	20
Puerto Rico	2,125,255	9
Rhode Island	824,534	3
South Carolina	1,426,739	10
South Dakota	163,986	3
Tennessee	2,218,007	9
Texas	11,372,246	32
Utah	1,319,551	4
Virginia	3,829,739	11
Vermont	87,088	1
Washington	3,214,738	10
Wisconsin	2,464,721	15
West Virginia	388,840	7
Wyoming	114,138	2
TOTAL	160,384,133	467*

*Urbanized areas which crossed state boundaries were counted more than once. There are 405 distinct urbanized areas nationwide.

Source: 1990 Census of Population and Housing, Bureau of the Census, U.S. Dept. of Commerce

OMB has defined 284 metropolitan areas based on the 1990 census. Figure 3-2 shows the location of the 284 metropolitan areas. These areas have a combined population of 192.7 million or 77 percent of the total U.S. population. This total includes rural populations of 26.5 million (14 percent of the metropolitan area population). Metropolitan areas occupy about 16.6 percent of the land area of the United States (about 88 percent of which is rural). There are 6,998 incorporated places (2,732 of which are rural) and 823 counties located in metropolitan areas. Table 3-3 provides a distribution of population inside and outside of metropolitan areas.

Table 3-3. Populations Inside and Outside of Metropolitan Areas in 1990

	Population	Area (sq.mi.)
Inside Metropolitan Area		
Urban in Urbanized Area	159,624,517	66,311
Urban Not in Urbanized Area	8,854,157	9,507
Rural	27,032,065	551,310
Outside Metropolitan Area		
Urban in Urbanized Area	1,537,739	1,394
Urban Not in Urbanized Area	19,583,295	18,023
Rural	35,701,936	3,136,894

Source: Bureau of the Census

3.1.2 Identification of Phase I Municipal Systems

Section 402(p) of the CWA identifies discharges from municipal separate storm sewer systems serving a population of 100,000 or more as Phase I sources under the NPDES storm water program. Municipal separate storm sewer systems serving a population of 100,000 or more are defined in the NPDES regulations at 40 *CFR* 122.26(b)(4) and (7) to include:

- Incorporated cities with a population of 100,000 or more
- Counties with populations of 100,000 or more in unincorporated, urbanized areas (excluding the population of towns and townships)
- Municipalities designated by EPA or an authorized NPDES State as having Phase I municipal separate storm sewer systems.

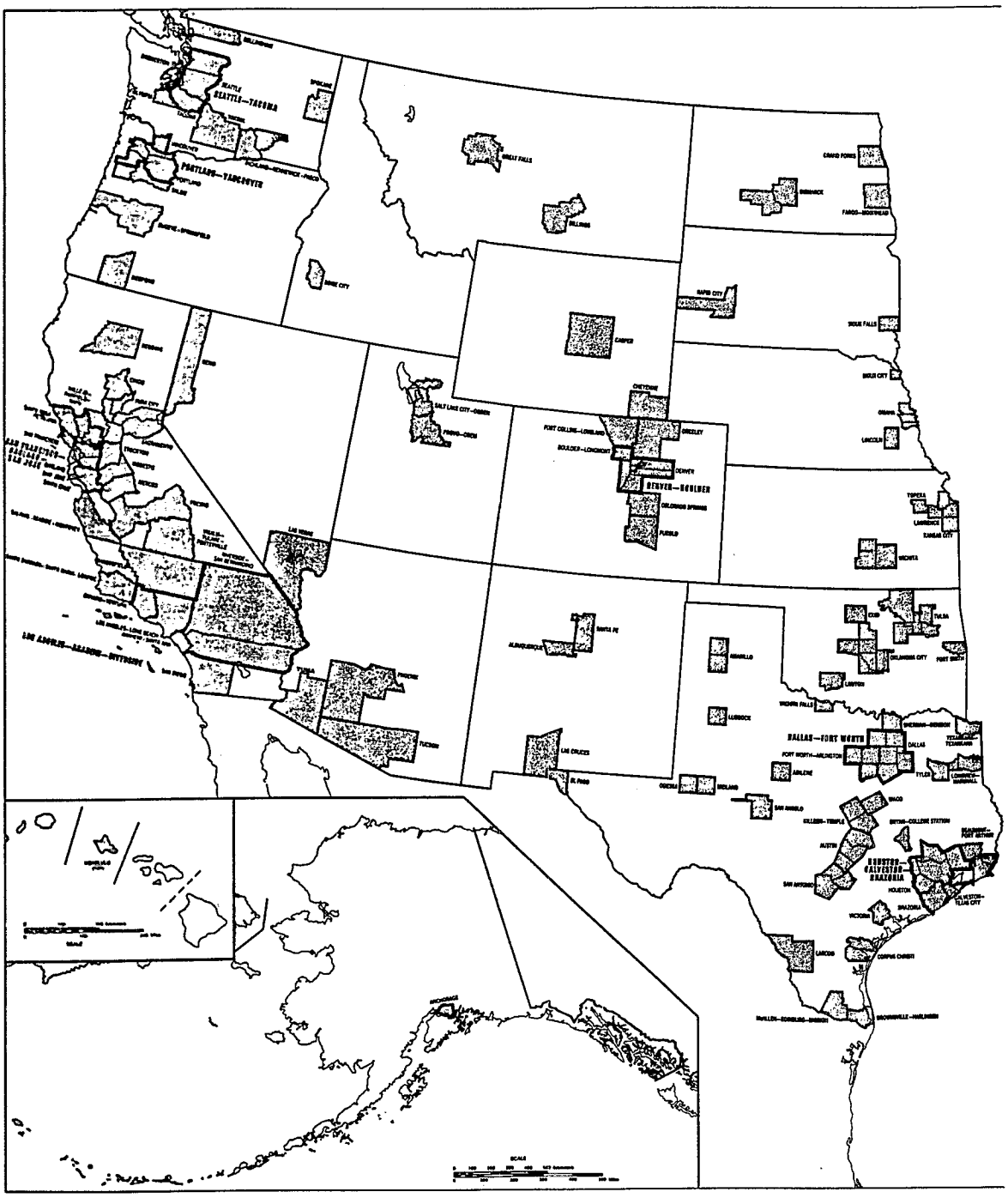


Figure 3-2. Metropolitan Areas of the United States

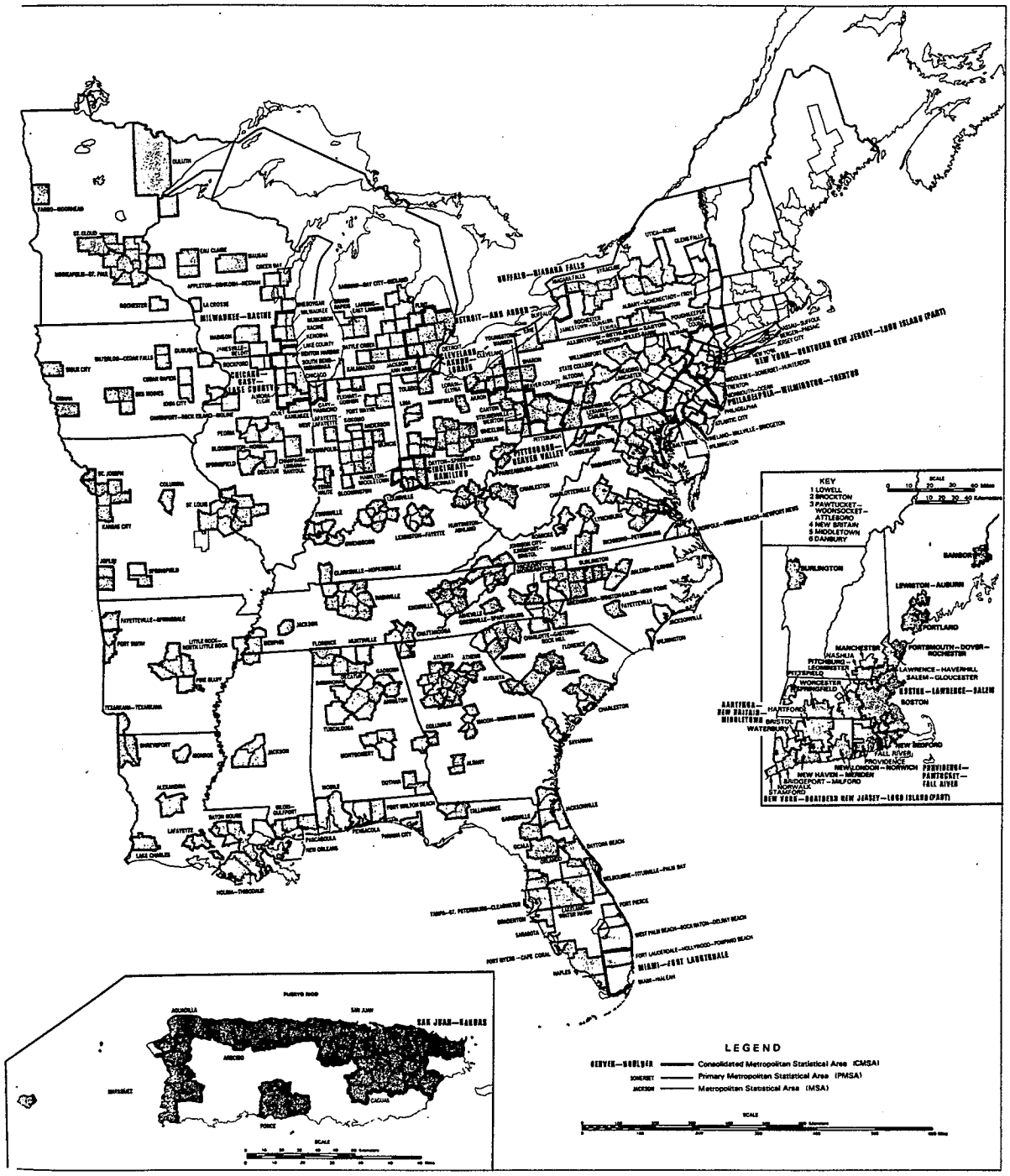


Figure 3-2. Metropolitan Areas of the United States (continued)

In addition, discharges from municipal separate storm sewer systems can be addressed under Phase I of the NPDES program if they are designated under Section 402(p)(2)(E) of the CWA as significant contributors of pollutants to waters of the United States or if they have contributed to a violation of a water quality standard.

Table 3-4 summarizes population and area estimates for municipalities with separate storm sewer systems subject to Phase I of the NPDES program. Appendix A lists Phase I municipal separate storm sewer systems. All but eight States (i.e., Maine, Montana, North Dakota, New Hampshire, New Jersey, Rhode Island, Vermont, and Wyoming) have one or more Phase I municipal separate storm sewer system. Table 3-5 summarizes Phase I municipal separate storm sewer systems by State.

Table 3-4. Municipalities Addressed by Phase I of the NPDES Storm Water Program

Phase I Municipalities		Number	Population (millions)	Area (sq.mi.)
Identified by Regulation*	Cities	140	50.9	17,634
	Counties	45	17.1 **	83,254 **
Designated by EPA/States	Cities	481	14.5	5,017
	Counties	32	3.5 **	27,862 **
	Other ***	60	NA	NA

* These counts exclude cities with a population of 100,000 or more that are exempted from Phase I of the water program due to populations served by combined sewers.

** Includes all of regulated counties. Of the 17.1 million people in counties identified by regulation, 14.6 are in urbanized unincorporated areas. Of the 3.5 million people in designated counties, 2.1 million are in urbanized unincorporated areas.

*** "Other" pertains to a municipality that is not defined by U.S. census political boundaries (i.e., State DOTs, drainage districts, universities, etc.).

Table 3-5. Summary of Phase I Municipalities (by State)

State / Territory	Identified by Regulation		Designated		Phase I Population
	Incorporated Places	Counties	Incorporated Places	Counties	
Alaska	1	0	0	0	226,338
Alabama	4	0	35	5	1,233,803
American Samoa	0	0	0	0	0
Arkansas	1	0	0	0	175,795
Arizona	4	1	0	0	2,066,289
California	25	9	217	6	23,496,438
Colorado	4	0	1	1	1,330,143
Connecticut	1	0	0	0	108,056
District of Columbia	1	0	0	0	606,900
Delaware	0	1	13	0	441,946
Florida	8	9	126	4	8,824,892
Georgia	4	4	35	5	2,870,325
Guam	0	0	0	0	0
Hawaii	0	1	0	0	847,952
Iowa	2	0	1	0	397,271
Idaho	1	0	1	0	132,107
Illinois	1	0	0	0	139,426
Indiana	2	0	0	0	904,399
Kansas	3	0	0	0	573,661
Kentucky	2	1	0	0	753,618
Louisiana	3	1	4	1	1,498,681
Massachusetts	2	0	1	0	847,481
Maryland	1	4	6	6	3,809,266
Maine	0	0	0	0	0
Michigan	5	0	0	0	702,153
Minnesota	2	0	0	0	640,618
Missouri	3	0	0	0	687,941
Mississippi	1	0	0	0	196,637
Montana	0	0	0	0	0

Table 3-5. Summary of Phase I Municipalities (by State) (continued)

State / Territory	Identified by Regulation		Designated		Phase I Population
	Incorporated Places	Counties	Incorporated Places	Counties	
North Carolina	5	1	1	0	1,325,072
North Dakota	0	0	0	0	0
Nebraska	2	0	0	0	527,767
Nevada	2	1	3	1	981,688
New Hampshire	0	0	0	0	0
New Jersey	0	0	0	0	0
New Mexico	1	0	0	0	384,736
New York	5	0	0	0	7,322,564
Northern Mariana Islands	0	0	0	0	0
Ohio	6	0	0	0	2,240,572
Oklahoma	2	0	0	0	812,021
Oregon	3	1	23	2	1,349,799
Palau	0	0	0	0	0
Pennsylvania	2	0	0	0	1,690,667
Puerto Rico	0	0	0	0	0
Rhode Island	0	0	0	0	0
South Carolina	0	2	0	0	397,573
South Dakota	1	0	0	0	100,814
Tennessee	4	0	9	0	1,484,247
Texas	15	1	4	0	7,843,991
Utah	1	1	0	0	434,446
Virgin Islands	0	0	0	0	0
Virginia	6	4	1	1	2,909,207
Vermont	0	0	0	0	0
Washington	2	3	0	0	1,895,943
Wisconsin	2	0	0	0	819,350
West Virginia	0	0	0	0	0
Wyoming	0	0	0	0	0
TOTAL	140	45	481	32	86,032,593

3.1.2.1 Incorporated Cities With a Population of 100,000 or More

The Phase I NPDES storm water regulations initially specifically identified 173 incorporated places with a population of more than 100,000.[4] However, 30 of the 173 cities with a population of 100,000 or more have been excluded from Phase I of the NPDES storm water program because, after the population served by combined sewers is subtracted from the total city population, the population served by separate storm sewers is less than 100,000.[5] Table 3-6 lists the cities excluded from Phase I because of populations served by combined sewers.

The description of Phase I sources presented in this report includes available information on cities given exemptions from Phase I because of populations served by combined sewers.

3.1.2.2 Counties With Urbanized, Unincorporated Populations of 100,000 or More

Phase I of the NPDES storm water regulations specifically identify municipal separate storm sewer systems in unincorporated portions of 45 counties as needing an NPDES permit.[6] Counties specifically identified in the Phase I regulations were described as having 100,000 or more people (based on the 1980 census) who live in unincorporated areas and are part of an urbanized area designated by the Bureau of the Census. EPA identified counties with large unincorporated, urbanized populations for regulation under Phase I of the NPDES

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[4] The specific cities listed in the current NPDES storm water regulations were based on 1980 census data. Thirty-five cities had populations of less than 100,000 under the 1980 census but have populations of 100,000 or more based on the 1990 census. Five cities had populations of more than 100,000 under the 1980 census but have populations of less than 100,000 based on the 1990 census. For the purposes of this Report, these 40 cities are not addressed as Phase I municipalities, unless they have been designated by EPA or an authorized NPDES State as needing a permit as of January 1994.

[5] To account for populations served by combined sewers, 40 *CFR* 122.26(f)(3) allows municipalities to petition EPA or an authorized NPDES State to reduce their population for the purpose of Phase I population determinations.

[6] The specific counties listed in the current NPDES storm water regulations were based on 1980 census data. Thirteen counties had unincorporated, urbanized populations of less than 100,000 under the 1980 census but have unincorporated, urbanized populations of 100,000 or more based on the 1990 census. Two counties had unincorporated, urbanized populations of more than 100,000 under the 1980 census but have unincorporated, urbanized populations of less than 100,000 based on the 1990 census. For the purposes of this Report, these 15 counties are not addressed as Phase I municipalities, unless they have been designated by EPA or an authorized NPDES State as needing a permit.

Table 3-6. Cities With Populations of 100,000 or More Given Exemption Under Phase I of the NPDES Storm Water Regulations Due to Combined Sewers

State	City	City Population	CSO Service Population
California	San Francisco	723,959	723,959
Connecticut	Bridgeport	141,686	50,000
	Hartford	139,739	110,000
	New Haven	130,474	84,300
	Waterbury	108,961	99,947
Illinois	Chicago	2,783,726	2,783,726
	Peoria	113,504	77,000
Indiana	Evansville	126,272	50,425
	Gary	116,646	116,646
	South Bend	105,511	100,000
Massachusetts	Springfield	156,983	156,983
Michigan	Detroit	1,027,974	1,017,880
	Livonia	100,850	100,850
	Lansing	127,321	50,000
Missouri	St. Louis	396,685	396,685
New Jersey	Elizabeth	110,002	107,000
	Jersey City	228,537	223,532
	Newark	275,221	275,221
	Paterson	140,891	140,891
New York	Buffalo	328,123	328,123
	Albany	101,082	96,500
	Rochester	231,636	231,636
	Syracuse	163,860	140,800
	Yonkers	188,082	184,812
Pennsylvania	Pittsburgh	369,879	369,879
	Erie	108,718	108,719
Rhode Island	Providence	160,728	160,728
Virginia	Alexandria	111,183	66,000
	Richmond	203,056	352,775
Washington	Spokane	177,196	135,600
TOTAL		9,198,485	8,840,617

storm water program because they were the primary municipal entity governing unincorporated areas. Because they are the primary municipal entity, these counties are the functional equivalent to an incorporated city for the purposes of a storm water program (i.e., the county generally performs many of the same functions and has the same legal and land use authority as incorporated cities). The 45 counties identified in this manner are located in 17 States, with the majority of the counties (33) being located in 6 States—Florida (9 counties), California (9 counties), Georgia (4 counties), Maryland (4 counties), Virginia (4 counties), and Washington (3 counties).

In 20 States, unincorporated portions of counties or county equivalents are divided into minor civil divisions. The criteria used to define Phase I municipal separate storm sewer systems did not address systems in counties with a population of 100,000 or more in these States, even where the unincorporated portions of the county were heavily urbanized. The Agency did not address such areas under Phase I of the program because of the complexities of the intergovernmental relationship between the county and incorporated places and minor civil divisions.

3.1.2.3 Designated Municipalities

The NPDES regulations authorize EPA or NPDES States to designate additional municipal systems as needing a permit under Phase I of the storm water program.[7] To date, 481 incorporated places and 32 counties have been designated by EPA and authorized NPDES States. These designated municipalities have a combined population of more than 18

[7] Designations can occur under two authorities. 40 *CFR* 122.26(b)(4) and (7) provide that additional municipal separate storm sewers may be designated as part of a system serving a population of 100,000 or more because of the interrelationship between the discharges of the designated storm sewers and the discharges from municipal separate storm sewers located in an incorporated place with a population of 100,000 or more or a county with an urbanized, unincorporated population of 100,000 or more. Additional municipal separate storm sewers within a region defined by a storm water management regional authority can be designated based on a jurisdictional, watershed, or other appropriate basis that includes an incorporated place with a population of 100,000 or more or a county with an urbanized, unincorporated population of 100,000 or more. Section 402(p)(2)(E) of the CWA provides that storm water discharges, including discharges from municipal separate storm sewer systems, that are a significant contributor of pollutants to waters of the United States or that have contributed to a violation of a water quality standard can be designated as needing a permit.

million. The majority of the designations (464 incorporated places and 28 counties) are in eight States (Alabama, California, Delaware, Florida, Georgia, Maryland, Oregon, and Tennessee). Municipalities have been designated as part of the Phase I NPDES storm water program in seven other States.

3.1.3 Identification of Potential Phase II Municipal Systems

Municipal separate storm sewer systems that are potentially subject to requirements under Phase II of the NPDES storm water program will be identified in terms of the following classes:

- Municipalities not addressed by Phase I, but located in an urbanized area with one or more Phase I municipalities
- Municipalities associated with an urbanized area without a Phase I municipality
- Urban populations outside of urbanized areas
- Rural populations
- Populations not addressed in the census.

3.1.3.1 Potential Phase II Municipalities Associated With Urbanized Areas With One or More Phase I Municipalities

Of the 405 urbanized areas designated by the Bureau of the Census, 136 have one or more municipalities with a separate storm sewer system addressed by Phase I of the NPDES storm water program. In most of these 136 urbanized areas, municipalities not addressed under Phase I are also found in the urbanized area. Table 3-7 lists the 136 urbanized areas with one or more Phase I municipalities. Table 3-8 summarizes the number of municipalities associated with different sizes of urbanized areas with a municipality with separate storm sewers subject to Phase I of the storm water program. Note that some urbanized areas cross state lines and are listed in the table in multiple states. In those cases, the portion of the urbanized area in each state is listed, rather than the total population within the urbanized area.

Table 3-7. Urbanized Areas With One or More Municipality in Phase I of the NPDES Storm Water Program

State	Urbanized Area	Total Population	Phase I Population	No. of Incorporated Places	No. of Minor Civil Divisions	No. of Counties
AK	Anchorage, AK	221,883	221,883	1	0	1
AL	Birmingham, AL	622,774	577,979	25	0	2
	Columbus, GA—AL	32,288	0	1	0	2
	Huntsville, AL	180,315	173,623	2	0	1
	Mobile, AL	300,912	255,494	6	0	1
	Montgomery, AL	210,007	187,106	2	0	3
AR	Little Rock—North Little Rock, AR	305,353	175,795	7	0	2
	Memphis, TN—AR—MS	34,600	0	3	0	1
AZ	Phoenix, AZ	2,006,239	1,410,951	15	0	2
	Tucson, AZ	579,235	567,493	3	0	1
CA	Antioch—Pittsburg, CA	153,768	146,205	3	0	1
	Bakersfield, CA	302,605	302,605	1	0	1
	Fairfield, CA	99,964	99,897	2	0	1
	Fresno, CA	453,388	403,065	2	0	1
	Hemet—San Jacinto, CA	90,929	90,929	2	0	1
	Hesperia—Apple Valley—Victorville, CA	153,176	66,646	3	0	1
	Indio—Coachella, CA	56,038	2,624	2	0	1
	Lancaster—Palmdale, CA	187,190	21,990	2	0	1
	Los Angeles, CA	11,402,946	11,402,946	115	0	4
	Modesto, CA	230,609	164,730	2	0	1
	Oxnard—Ventura, CA	480,482	387,907	7	0	2
	Palm Springs, CA	129,025	13,200	6	0	1
	Riverside—San Bernardino, CA	1,170,196	1,170,196	13	0	2
	Sacramento, CA	1,097,005	100,4620	5	0	3
	Salinas, CA	122,225	108,777	1	0	1
	San Diego, CA	2,348,417	2,348,417	18	0	1
	San Francisco—Oakland, CA	3,629,516	2,644,467	63	0	7
	San Jose, CA	1,435,019	1,411,091	14	0	1
	Simi Valley, CA	128,043	128,043	2	0	1
	Stockton, CA	262,046	210,943	1	0	1
CO	Colorado Springs, CO	352,989	280,995	3	0	1
	Denver, CO	1,517,977	918,955	23	0	7
	Pueblo, CO	106,155	98,640	1	0	1
CT	Stamford, CT—NY	187,180	108,056	1	4	1
	Worcester, MA—CT	555	0	0	1	1
DC	Washington, DC—MD—VA	606,900	606,900	1	0	1
DE	Wilmington, DE—NJ—MD—PA	407,962	407,962	9	0	1
FL	Fort Lauderdale—Hollywood—Pompano Beach, FL	1,238,134	1,183,036	27	0	1
	Fort Myers—Cape Coral, FL	220,552	102,337	2	0	1
	Jacksonville, FL	738,413	627,128	6	0	3
	Lakeland, FL	147,628	147,628	2	0	1
	Miami—Hialeah, FL	1,914,660	1,902,397	25	0	1
	Orlando, FL	887,126	746,006	17	0	2
	Pensacola, FL	253,558	225,628	2	0	2
	Sarasota—Bradenton, FL	444,385	375,194	8	0	3
	Spring Hill, FL	52,056	3,463	1	0	2
	Tallahassee, FL	155,884	124,773	1	0	1

Table 3-7. Urbanized Areas With One or More Municipality in Phase I of the NPDES Storm Water Program (continued)

State	Urbanized Area	Total Population	Phase I Population	No. of Incorporated Places	No. of Minor Civil Divisions	No. of Counties
FL	Tampa—St.Petersburg—Clearwater, FL	1,708,710	1,680,343	28	0	3
	West Palm Beach—Boca Raton—Delray Beach, FL	794,848	791,286	34	0	2
	Winter Haven, FL	86,427	86,427	4	0	1
GA	Atlanta, GA	2,157,806	2,031,973	38	0	11
	Augusta, GA—SC	217,002	151,214	2	0	2
	Chattanooga, TN—GA	46,194	0	4	0	3
	Columbus, GA—AL	188,410	173,196	2	0	2
	Macon, GA	129,496	125,952	2	0	2
	Savannah, GA	198,630	194,888	7	0	1
HI	Honolulu, HI	632,603	632,603	0	0	1
	Kailua, HI	114,506	114,506	0	0	1
IA	Cedar Rapids, IA	136,190	108,751	4	0	1
	Davenport—Rock Island—Moline, IA—IL	128,950	94,942	6	0	1
	Des Moines, IA	293,666	193,187	9	0	3
	Omaha, NE—IA	59,890	0	2	0	1
ID	Boise City, ID	167,941	132,107	2	0	1
IL	Davenport—Rock Island—Moline, IA—IL	135,068	0	11	10	2
	Rockford, IL	207,826	139,426	5	5	1
IN	Fort Wayne, IN	248,424	173,072	2	9	1
	Indianapolis, IN	914,761	731,327	24	20	6
	Louisville, KY—IN	100,159	0	4	5	2
KS	Kansas City, MO—KS	480,249	149,767	17	3	2
	Topeka, KS	132,711	119,883	1	5	1
	Wichita, KS	338,789	304,011	6	10	1
KY	Cincinnati, OH—KY	236,349	0	33	0	3
	Lexington-Fayette, KY	220,701	218,925	1	0	2
	Louisville, KY—IN	654,797	508,493	97	0	2
LA	Baton Rouge, LA	365,943	322,070	5	0	3
	New Orleans, LA	1,040,226	938,384	5	0	5
	Shreveport, LA	256,489	198,525	2	0	2
MA	Boston, MA	2,775,370	574,283	19	76	7
	Lowell, MA-NH	180,716	103,439	1	8	1
	Worcester, MA—CT	315,111	169,759	1	18	1
MD	Annapolis, MD	78,590	78,488	2	0	1
	Baltimore, MD	1,889,873	1,889,873	2	0	5
	Frederick, MD	58,393	14,100	2	0	1
	Hagerstown, MD—PA—WV	68,226	28,321	4	0	1
	Washington, DC—MD—VA	1,420,999	1,169,907	39	0	4
	Wilmington, DE—NJ—MD—PA	13,732	0	1	0	1
MI	Ann Arbor, MI	222,061	109,592	3	7	2
	Detroit, MI	3,697,529	262,674	76	33	5
	Flint, MI	326,023	140,761	8	12	1
	Grand Rapids, MI	436,336	189,126	7	8	2
	Toledo, OH—MI	18,817	0	0	3	1
MN	Minneapolis—St.Paul, MN	2,079,676	640,618	92	3	8

Table 3-7. Urbanized Areas With One or More Municipality in Phase I of the NPDES Storm Water Program (continued)

State	Urbanized Area	Total Population	Phase I Population	No. of Incorporated Places	No. of Minor Civil Divisions	No. of Counties
MO	Kansas City, MO—KS	795,068	545,197	31	20	4
	Springfield, MO	159,086	140,494	2	9	2
MS	Jackson, MS	289,285	196,637	8	0	3
	Memphis, TN—AR—MS	29,341	0	2	0	1
NC	Charlotte, NC	455,597	395,934	6	0	2
	Durham, NC	205,355	136,611	3	0	2
	Fayetteville, NC	241,763	222,522	3	0	2
	Greensboro, NC	194,508	183,521	1	0	1
	Raleigh, NC	305,925	207,951	4	0	1
	Winston-Salem, NC	185,184	143,485	4	0	2
NE	Lincoln, NE	192,558	191,972	1	0	1
	Omaha, NE—IA	484,402	335,795	6	0	2
NH	Lowell, MA-NH	935	0	0	1	1
NJ	Allentown—Bethlehem—Easton, PA—NJ	24,817	0	2	2	1
	New York, NY—Northeastern New Jersey	5,113,880	0	192	96	12
	Philadelphia, PA—NJ	944,875	0	43	37	3
	Wilmington, DE—NJ—MD—PA	26,043	0	1	2	1
NM	Albuquerque, NM	497,120	384,736	4	0	2
	El Paso, TX—NM	8,179	0	1	0	1
NV	Las Vegas, NV	697,348	697,348	3	0	1
	Reno, NV	213,747	213,747	2	0	1
NY	New York, NY—Northeastern New Jersey	10,930,132	7,322,564	125	36	10
	Stamford, CT—NY	20	0	0	1	1
OH	Akron, OH	527,863	223,019	20	14	5
	Cincinnati, OH—KY	976,326	364,040	40	20	4
	Cleveland, OH	1,677,492	505,616	76	16	7
	Columbus, OH	945,237	632,910	24	24	5
	Dayton, OH	613,467	182,044	17	16	4
	Toledo, OH—MI	470,338	332,943	12	7	3
OK	Oklahoma City, OK	784,425	438,922	23	0	5
	Tulsa, OK	474,668	367,302	6	0	5
OR	Eugene—Springfield, OR	189,192	112,669	2	0	1
	Portland—Vancouver, OR—WA	1,004,676	978,531	22	0	3
	Salem, OR	157,079	94,983	2	0	2
PA	Allentown—Bethlehem—Easton, PA—NJ	385,619	105,090	18	18	2
	Hagerstown, MD—PA—WV	1,212	0	0	1	1
	Philadelphia, PA—NJ	3,277,336	1,585,577	67	84	5
	Wilmington, DE—NJ—MD—PA	1,879	0	0	4	2
SC	Augusta, GA—SC	69,536	0	3	0	2
	Columbia, SC	328,349	130,589	9	0	2
	Greenville, SC	248,173	147,464	6	0	3
SD	Sioux Falls, SD	100,843	100,814	1	3	2
TN	Chattanooga, TN—GA	250,761	152,466	9	0	1
	Knoxville, TN	304,466	165,121	5	0	4
	Memphis, TN—AR—MS	761,252	637,326	3	0	1
	Nashville, TN	573,294	508,828	10	0	4

Table 3-7. Urbanized Areas With One or More Municipality in Phase I of the NPDES Storm Water Program (continued)

State	Urbanized Area	Total Population	Phase I Population	No. of Incorporated Places	No. of Minor Civil Divisions	No. of Counties
TX	Abilene, TX	107,836	106,654	3	0	2
	Amarillo, TX	157,934	157,615	1	0	2
	Austin, TX	562,008	465,622	7	0	2
	Beaumont, TX	122,841	114,323	3	0	2
	Corpus Christi, TX	270,006	257,453	2	0	3
	Dallas—Fort Worth, TX	3,198,259	2,493,364	56	0	9
	El Paso, TX—NM	562,838	515,187	3	0	1
	Houston, TX	2,901,851	2,468,419	34	0	7
	Laredo, TX	123,651	122,899	1	0	1
	Lubbock, TX	187,906	186,206	1	0	1
	San Antonio, TX	1,129,154	935,933	18	0	3
	Waco, TX	144,372	103,590	8	0	1
UT	Salt Lake City, UT	789,447	430,716	16	0	2
VA	Norfolk—Virginia Beach—Newport News, VA	1,323,098	1,204,925	10	0	12
	Petersburg, VA	103,526	12,115	3	0	6
	Richmond, VA	589,980	363,740	1	0	4
	Roanoke, VA	178,277	96,397	3	0	5
	Washington, DC—MD—VA	1,335,132	1,088,797	8	0	9
WA	Portland—Vancouver, OR—WA	167,482	0	1	0	1
	Seattle, WA	1,744,086	1,193,945	30	0	3
	Tacoma, WA	497,210	435,194	11	0	2
WI	Madison, WI	244,336	191,262	7	6	1
	Milwaukee, WI	1,226,293	628,088	35	11	5
WV	Hagerstown, MD—PA—WV	768	0	0	0	1

Table 3-8. Municipalities in Urbanized Areas With One or More Phase I Municipalities

Urbanized Area Population	Number of Urbanized Areas	Phase I Municipalities			Portions of Urbanized Areas Not in Phase I				
		Incorp. Places	Counties	Phase I Population	Incorp. Places	Minor Civil Divisions	Counties	Phase II Population	Total Population
50,000 - 74,999	4	0	4	48,508	9	1	3	188,185	236,693
75,000 - 99,999	4	9	2	355,741	1	0	1	169	355,910
100,000 - 124,999	8	6	2	778,728	7	3	14	122,855	901,583
125,000 - 149,999	7	8	2	747,047	17	5	4	200,418	947,465
150,000 - 249,999	32	37	9	4,780,942	45	50	44	1,542,672	6,323,614
Over 250,000	81	504	53	75,004,440	1,508	575	239	33,650,057	108,654,497
TOTALS	136	564	72	81,715,406	1,587	634	305	35,704,356	117,419,762

The 136 urbanized areas with one or more municipality with a separate storm sewer system addressed by Phase I have a total population of 117.5 million (47 percent of the total U.S. population). The portions of these urbanized areas currently not addressed by Phase I of the NPDES storm water program have a combined population of 35.7 million people. Of the 35.7 million people, 32.9 million people live in 1,587 incorporated places and 634 minor civil divisions. The remaining 2.9 million people live in unincorporated areas. EPA estimates that 305 counties currently not addressed by Phase I of the NPDES storm water program are part of an urbanized area in which one or more municipalities are in Phase I.

Two general patterns of municipal governments can be used to describe the 136 urbanized areas that have one or more Phase I municipalities. Most of the 136 urbanized areas can be described as having a large core city with a population of 100,000 that is addressed by Phase I of the program, with a large number of smaller potential Phase II incorporated places and minor civil divisions surrounding the core city. Figure 3-3 provides an example of this pattern, which illustrates the Milwaukee, Wisconsin, urbanized area.

The second pattern of municipal government for the 136 urbanized areas consists of counties that do not have minor civil divisions. Urbanized areas that follow this pattern are comprised of a core city (which is usually addressed by Phase I) surrounded by a combination of unincorporated portions of counties and incorporated places. In urbanized areas that follow this pattern, unincorporated portions of one or more of the counties surrounding the core city may be in Phase I, while the smaller incorporated places surrounding the core city are generally not addressed by Phase I. Figure 3-4 gives an example of this pattern, which illustrates the Washington, D.C., urbanized area. Figure 3-4 also shows that Phase I jurisdiction for this urbanized area generally extends beyond the 1990 boundaries of the urbanized area. In this manner, Phase I addresses much of the new development associated with the expanding urbanized population, even though it occurs outside of the 1990 urbanized area boundary.

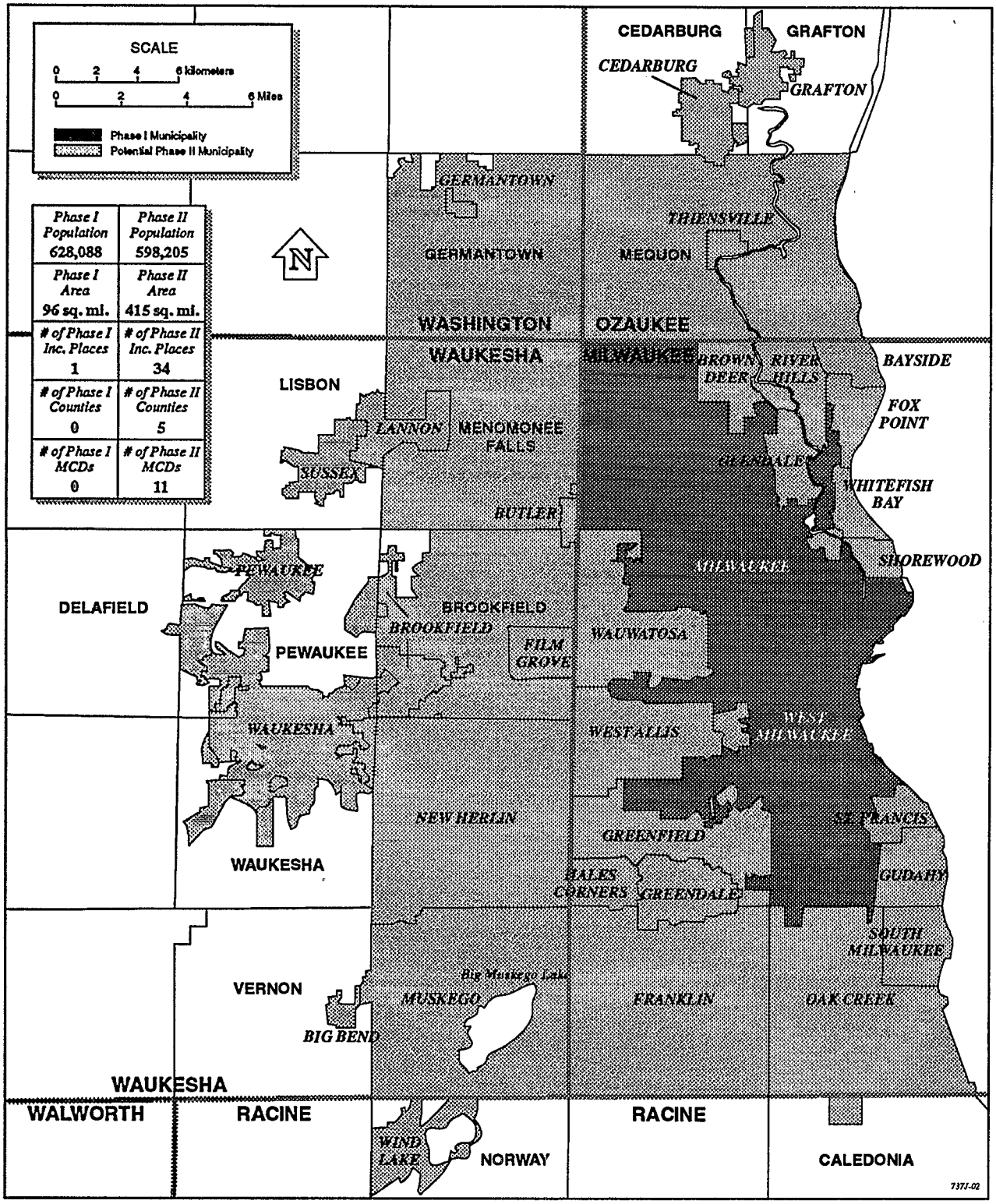


Figure 3-3. Phase I and Phase II Portions of Milwaukee, Wisconsin, Urbanized Area

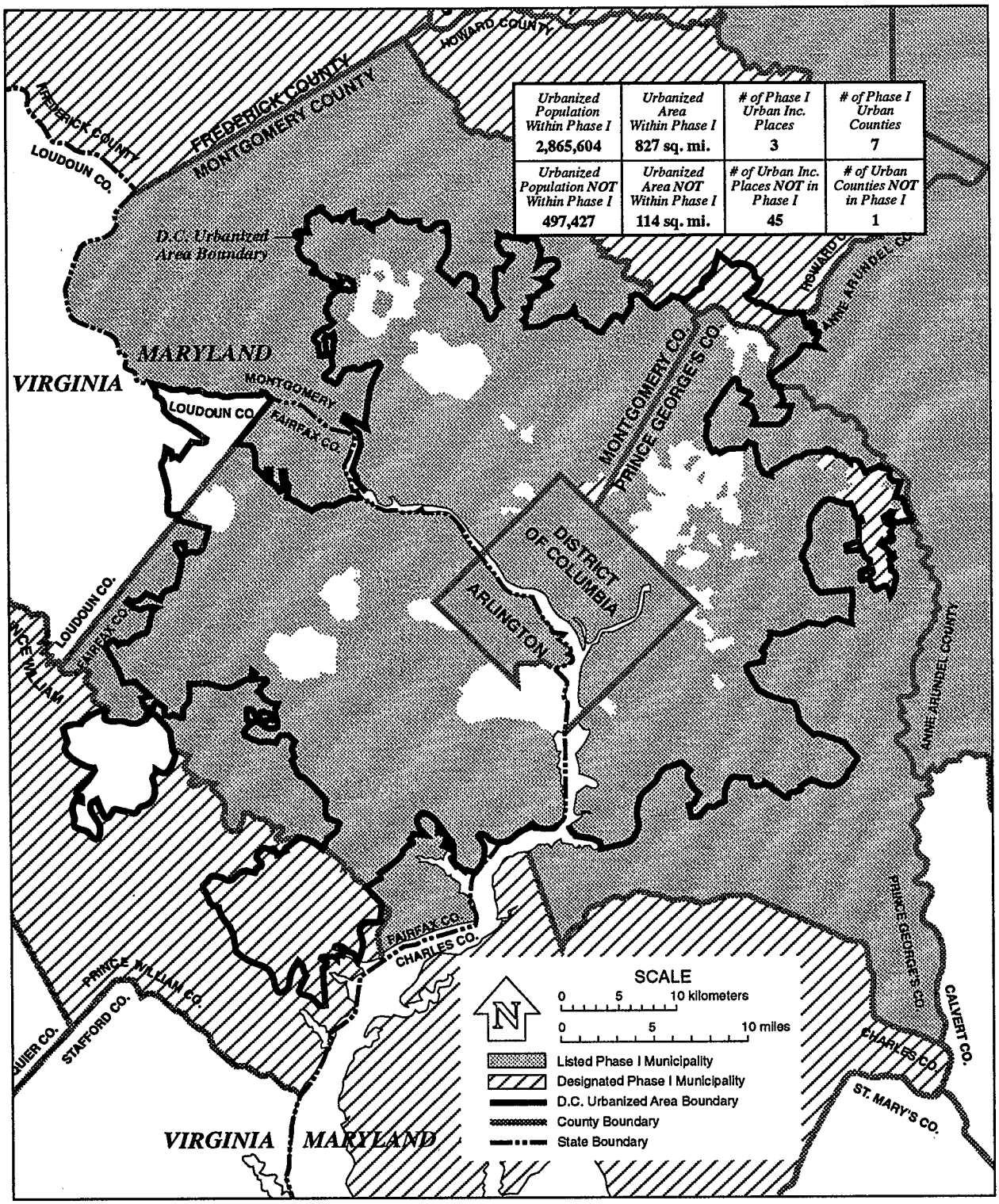


Figure 3-4. Phase I and Phase II Portions of Washington, DC, Urbanized Area

3.1.3.2 Potential Phase II Municipalities Associated With Urbanized Areas Without a Phase I Municipality

A total of 269 of the Census-designated urbanized areas currently do not have any municipalities with separate storm sewers subject to Phase I of the storm water program. Table 3-9 lists these urbanized areas. As in Table 3-7, note that some urbanized areas cross state lines and are listed in the table in multiple states along with the portion of the population in that state. Table 3-10 summarizes the population and number of municipalities associated with different classes of urbanized areas without a municipality with separate storm sewers subject to Phase I of the storm water program. Of the 269 urbanized areas, 101 (more than a third) have a population of more than 100,000 and 23 have a population of more than 250,000. These 269 urbanized areas without a Phase I municipal separate storm sewer system have a combined population of 42.9 million people (16 percent of the total U.S. population). Of the 42.9 million people, 37.1 million people live in 1,470 incorporated places and 966 minor civil divisions. The remaining 5.8 million people live in unincorporated areas. EPA estimates that 380 counties that are part of an urbanized area do not have a municipality addressed by Phase I of the NPDES storm water program.

Twenty-one urbanized areas have an incorporated city with a population of 100,000 or more that are not subject to Phase I of the NPDES storm water program because of populations served by combined sewers. Table 3-11 lists these urbanized areas. The 21 urbanized areas have a combined population of 17.5 million people, of which an estimated 11.7 million people are served by separate storm sewers. Three of these urbanized areas (i.e., Chicago, St. Louis, and Pittsburgh) have populations of more than a million people that are served by separate storm sewers. Of the remaining urbanized areas, 10 have a population of more than 250,000 and 7 have a population of more than 175,000, but less than 250,000. Of the 17.5 million people that live in the 21 urbanized areas, 6.0 million people live in cities with a population of 100,000 or more.

Table 3-9. List of Urbanized Areas Not Associated With a Phase I Municipality

State	Urbanized Area	Total Population	No. of Incorporated Places	No. of Minor Civil Divisions	No. of Counties
AL	Anniston, AL	68,150	5	0	2
	Auburn—Opelika, AL	56,510	2	0	1
	Decatur, AL	63,541	4	0	2
	Dothan, AL	58,925	5	0	2
	Florence, AL	69,186	4	0	2
	Gadsden, AL	71,630	6	0	2
	Tuscaloosa, AL	106,428	2	0	1
AR	Fayetteville—Springdale, AR	74,880	5	0	2
	Fort Smith, AR—OK	91,870	3	0	2
	Pine Bluff, AR	61,941	2	0	1
	Texarkana, TX—Texarkana, AR	22,776	1	0	1
AZ	Yuma, AZ-CA	70,523	1	0	1
CA	Chico, CA	71,831	1	0	1
	Davis, CA	52,711	1	0	1
	Lodi, CA	55,590	1	0	1
	Lompoc, CA	56,591	1	0	1
	Merced, CA	64,742	1	0	1
	Napa, CA	68,049	1	0	1
	Redding, CA	78,364	1	0	1
	San Luis Obispo, CA	50,305	1	0	1
	Santa Barbara, CA	182,163	2	0	1
	Santa Cruz, CA	152,355	3	0	1
	Santa Maria, CA	88,989	1	0	1
	Santa Rosa, CA	194,560	3	0	1
	Seaside—Monterey, CA	133,188	7	0	1
	Vacaville, CA	71,535	1	0	1
	Visalia, CA	83,594	1	0	1
	Watsonville, CA	51,378	1	0	2
	Yuba City, CA	77,167	2	0	2
	Yuma, AZ—CA	432	0	0	1
CO	Boulder, CO	98,910	1	0	1
	Fort Collins, CO	105,809	1	0	1
	Grand Junction, CO	71,938	1	0	1
	Greeley, CO	71,578	4	0	1
	Longmont, CO	52,464	1	0	1
CT	Bridgeport—Milford, CT	413,863	6	14	2
	Bristol, CT	92,418	1	7	3
	Danbury, CT—NY	112,647	1	7	2
	Hartford—Middletown, CT	546,198	2	19	3
	New Britain, CT	143,064	1	5	1
	New Haven—Meriden, CT	451,486	3	16	3
	New London—Norwich, CT	156,286	3	13	1
	Norwalk, CT	108,888	1	5	1
	Springfield, MA—CT	68,045	0	6	2
	Waterbury, CT	175,067	2	8	2
DE	Dover, DE	50,787	3	0	1
FL	Daytona Beach, FL	221,341	9	0	1
	Deltona, FL	58,053	0	0	1
	Fort Pierce, FL	126,342	3	0	1
	Fort Walton Beach, FL	112,522	7	0	3

Table 3-9. List of Urbanized Areas Not Associated With a Phase I Municipality (continued)

State	Urbanized Area	Total Population	No. of Incorporated Places	No. of Minor Civil Divisions	No. of Counties
FL	Gainesville, FL	126,215	1	0	1
	Kissimmee, FL	55,419	1	0	1
	Melbourne—Palm Bay, FL	305,978	13	0	1
	Naples, FL	94,344	1	0	1
	Ocala, FL	68,004	1	0	1
	Panama City, FL	103,667	6	0	1
	Punta Gorda, FL	67,033	1	0	1
	Stuart, FL	80,069	3	0	2
	Titusville, FL	51,549	1	0	1
	Vero Beach, FL	64,707	2	0	1
GA	Albany, GA	87,223	1	0	2
	Athens, GA	73,282	2	0	2
	Brunswick, GA	50,066	1	0	1
	Rome, GA	51,589	1	0	1
	Warner Robins, GA	60,976	2	0	1
IA	Dubuque, IA—IL	61,048	2	0	1
	Iowa City, IA	71,372	3	0	1
	Sioux City, IA—NE—SD	83,277	2	0	1
	Waterloo—Cedar Falls, IA	108,260	5	0	1
ID	Idaho Falls, ID	56,356	3	0	1
	Pocatello, ID	53,903	2	0	2
IL	Alton, IL	86,236	7	8	1
	Aurora, IL	192,043	7	10	3
	Beloit, WI—IL	13,371	3	3	1
	Bloomington—Normal, IL	94,186	2	4	1
	Champaign—Urbana, IL	115,524	3	7	1
	Chicago, IL—Northwestern Indiana	6,301,112	179	61	5
	Crystal Lake, IL	72,498	7	6	3
	Decatur, IL	96,039	4	8	1
	Dubuque, IA—IL	2,657	1	1	1
	Elgin, IL	123,899	7	6	2
	Joliet, IL	170,717	8	9	1
	Kankakee, IL	59,695	4	5	1
	Peoria, IL	242,353	12	16	3
	Round Lake Beach—McHenry, IL—WI	112,640	14	10	2
	Saint Louis, MO-IL	328,299	26	19	3
	Springfield, IL	124,524	5	7	1
IN	Anderson, IN	74,037	7	7	2
	Bloomington, IN	71,440	1	4	1
	Chicago, IL—Northwestern Indiana	490,975	19	12	2
	Elkhart—Goshen, IN	98,787	2	6	1
	Evansville, IN—KY	156,570	2	7	2
	Kokomo, IN	57,146	1	5	1
	Lafayette—West Lafayette, IN	100,103	2	6	1
	Muncie, IN	88,073	3	5	1
	South Bend—Mishawaka, IN—MI	215,182	5	9	2
	Terre Haute, IN	77,019	3	6	1

Table 3-9. List of Urbanized Areas Not Associated With a Phase I Municipality (continued)

State	Urbanized Area	Total Population	No. of Incorporated Places	No. of Minor Civil Divisions	No. of Counties
KS	Lawrence, KS	65,755	1	1	1
	St. Joseph, MO—KS	1,100	1	1	1
KY	Clarksville, TN—KY	21,724	1	0	1
	Evansville, IN—KY	26,517	1	0	1
	Huntington—Ashland, WV—KY—OH	56,122	8	0	2
	Owensboro, KY	60,645	1	0	1
LA	Alexandria, LA	86,001	3	0	1
	Houma, LA	65,879	1	0	2
	Lafayette, LA	129,592	4	0	1
	Lake Charles, LA	119,067	3	0	1
	Monroe, LA	110,737	3	0	1
	Slidell, LA	54,084	1	0	1
MA	Brockton, MA	160,910	1	9	3
	Fall River, MA—RI	126,508	1	4	1
	Fitchburg—Leominster, MA	82,249	2	2	1
	Hyannis, MA	66,713	0	5	1
	Lawrence—Haverhill, MA—NH	212,000	2	7	1
	New Bedford, MA	139,082	1	3	1
	Pittsfield, MA	55,047	1	3	1
	Providence—Pawtucket, RI—MA	93,090	1	10	3
	Springfield, MA—CT	464,702	5	14	2
	Taunton, MA	58,884	1	3	1
MD	Cumberland, MD—WV	51,648	2	0	1
ME	Bangor, ME	61,402	3	2	1
	Lewiston—Auburn, ME	71,598	2	2	1
	Portland, ME	120,220	3	4	1
	Portsmouth—Dover—Rochester, NH—ME	13,512	0	5	1
MI	Battle Creek, MI	77,921	2	4	2
	Bay City, MI	74,118	2	5	1
	Benton Harbor, MI	57,744	4	4	1
	Holland, MI	62,418	2	4	2
	Jackson, MI	78,126	1	4	1
	Kalamazoo, MI	164,430	3	7	1
	Lansing—East Lansing, MI	265,095	2	7	3
	Muskegon, MI	106,252	5	5	1
	Port Huron, MI	62,774	3	7	1
	Saginaw, MI	140,079	2	8	1
	South Bend—Mishawaka, IN—MI	22,750	1	3	2
MN	Duluth, MN—WI	95,356	3	1	1
	Fargo—Moorhead, ND—MN	34,923	2	2	1
	Grand Forks, ND—MN	8,658	1	0	1
	LaCrosse, WI—MN	4,725	1	1	1
	Rochester, MN	73,560	1	3	1
	St. Cloud, MN	74,037	4	5	3
MO	Columbia, MO	75,854	1	4	1
	Joplin, MO	60,208	15	5	2
	St. Joseph, MO—KS	74,295	2	4	2
	St. Louis, MO—IL	1,618,227	95	39	4

Table 3-9. List of Urbanized Areas Not Associated With a Phase I Municipality (continued)

State	Urbanized Area	Total Population	No. of Incorporated Places	No. of Minor Civil Divisions	No. of Counties
MS	Biloxi—Gulfport, MS	179,643	8	0	3
	Hattiesburg, MS	59,757	2	0	2
	Pascagoula, MS	59,386	3	0	1
MT	Billings, MT	88,181	1	0	1
	Great Falls, MT	63,506	1	0	1
	Missoula, MT	57,196	1	0	1
NC	Asheville, NC	110,429	7	0	2
	Burlington, NC	74,053	6	0	3
	Gastonia, NC	113,637	9	0	1
	Goldsboro, NC	60,230	1	0	1
	Greenville,NC	55,884	2	0	1
	Hickory, NC	69,914	6	0	2
	High Point, NC	108,686	4	0	4
	Jacksonville, NC	101,297	1	0	1
	Kannapolis, NC	78,177	4	0	2
	Rocky Mount, NC	50,870	1	0	2
	Wilmington, NC	101,357	4	0	2
ND	Bismarck, ND	66,476	3	2	2
	Fargo—Moorhead, ND—MN	86,413	2	2	1
	Grand Forks, ND—MN	49,445	1	1	1
NE	Sioux City, IA—NE—SD	10,915	1	0	1
NH	Lawrence—Haverhill, MA—NH	25,362	0	3	1
	Lowell, MA—NH	935	0	1	1
	Manchester, NH	114,918	1	6	3
	Nashua, NH	96,791	1	5	1
	Portsmouth—Dover—Rochester, NH—ME	101,448	4	6	2
NJ	Atlantic City, NJ	169,993	11	3	2
	Trenton, NJ—PA	255,696	4	7	2
	Vineland—Millville, NJ	94,236	4	5	4
NM	Las Cruces, NM	81,471	2	0	1
	Santa Fe, NM	63,023	1	0	1
NY	Albany—Schenectady—Troy, NY	509,106	11	19	4
	Binghamton, NY	158,405	4	10	2
	Buffalo—Niagara Falls, NY	954,332	14	16	2
	Danbury, CT—NY	3,593	0	1	1
	Elmira, NY	66,612	3	6	1
	Glens Falls, NY	56,475	4	4	3
	Ithaca, NY	50,132	3	3	1
	Newburgh, NY	71,584	2	4	1
	Poughkeepsie, NY	148,527	4	8	2
	Rochester, NY	619,653	6	12	1
	Syracuse, NY	388,918	11	12	2
	Utica—Rome, NY	158,553	9	11	2
OH	Canton, OH	244,576	6	8	1
	Hamilton, OH	118,315	4	7	2
	Huntington—Ashland, WV—KY—OH	33,791	6	6	1
	Lima, OH	68,621	3	5	2
	Lorain—Elyria, OH	224,087	10	8	2

Table 3-9. List of Urbanized Areas Not Associated With a Phase I Municipality (continued)

State	Urbanized Area	Total Population	No. of Incorporated Places	No. of Minor Civil Divisions	No. of Counties
OH	Mansfield, OH	76,521	3	5	1
	Middletown, OH	98,822	6	8	3
	Newark, OH	54,063	2	5	1
	Parkersburg, WV—OH	6,840	1	1	1
	Sharon, PA—OH	6,229	0	2	1
	Springfield, OH	88,649	1	3	1
	Steubenville—Weirton, OH—WV—PA	38,855	4	4	1
	Wheeling, WV—OH	25,255	5	4	1
	Youngstown—Warren, OH	361,627	12	13	2
OK	Fort Smith, AR—OK	2,616	2	0	2
	Lawton, OK	92,634	1	0	1
OR	Longview, WA—OR	2,138	1	0	1
	Medford, OR	66,974	3	0	1
PA	Altoona, PA	76,551	3	6	1
	Erie, PA	177,668	2	6	1
	Harrisburg, PA	292,904	17	16	5
	Johnstown, PA	77,841	14	10	2
	Lancaster, PA	193,583	7	13	2
	Monessen, PA	65,072	20	6	3
	Pittsburgh, PA	1,678,745	136	73	5
	Pottstown, PA	53,371	2	8	3
	Reading, PA	186,267	16	12	1
	Scranton—Wilkes-Barre, PA	388,225	44	19	2
	Sharon, PA—OH	46,587	6	2	1
	State College, PA	61,239	1	4	1
	Steubenville—Weirton, OH—WV—PA	392	0	1	1
	Trenton, NJ—PA	42,906	2	3	1
	Williamsport, PA	57,425	4	5	1
	York, PA	142,675	11	10	1
PR[1]	Aquadilla, PR	99,936			
	Arecibo, PR	88,967			
	Caguas, PR	190,922			
	Cayey, PR	53,945			
	Humacao, PR	57,144			
	Mayaguez, PR	110,904			
	Ponce, PR	190,079			
	San Juan, PR	1,221,086			
	Vega Baja-Manatil, PR	112,272			
RI	Fall River, MA—RI	17,850	0	2	1
	Newport, RI	53,481	1	3	1
	Providence—Pawtucket, RI—MA	753,203	7	17	4
SC	Anderson, SC	52,492	1	0	1
	Charleston, SC	393,956	10	0	3
	Florence, SC	54,659	2	0	2
	Myrtle Beach, SC	58,384	2	0	2
	Rock Hill, SC	58,757	2	0	1
	Spartanburg, SC	104,801	2	0	1
	Sumter, SC	57,632	1	0	1

Table 3-9. List of Urbanized Areas Not Associated With a Phase I Municipality (continued)

State	Urbanized Area	Total Population	No. of Incorporated Places	No. of Minor Civil Divisions	No. of Counties
SD	Rapid City, SD	61,124	1	0	1
	Sioux City, IA—NE—SD	2,019	1	1	1
TN	Bristol, TN—Bristol, VA	33,790	1	0	1
	Clarksville, TN—KY	75,857	1	0	1
	Jackson, TN	53,031	1	0	1
	Johnson City, TN	82,382	3	0	3
	Kingsport, TN—VA	83,174	3	0	3
TX	Brownsville, TX	117,676	1	0	1
	Bryan—College Station, TX	107,599	2	0	1
	Denton, TX	66,445	1	0	1
	Galveston, TX	58,263	1	0	1
	Harlingen, TX	79,309	5	0	1
	Killeen, TX	137,876	4	0	3
	Lewisville, TX	79,433	7	0	3
	Longview, TX	76,429	2	0	2
	McAllen—Edinburg—Mission, TX	263,192	9	0	1
	Midland, TX	91,999	1	0	2
	Odessa, TX	113,672	1	0	2
	Port Arthur, TX	109,560	4	0	1
	San Angelo, TX	85,408	1	0	1
	Sherman—Denison, TX	55,522	3	0	1
	Temple, TX	58,710	2	0	1
	Texarkana, TX—Texarkana, AR	42,310	3	0	1
	Texas City, TX	128,211	9	0	2
	Tyler, TX	79,703	1	0	1
	Victoria, TX	55,122	1	0	1
	Wichita Falls, TX	97,151	2	0	2
UT	Logan, UT	50,401	7	0	1
	Ogden, UT	259,147	20	0	2
	Provo—Orem, UT	220,556	10	0	1
VA	Bristol, TN—Bristol, VA	18,773	1	0	2
	Charlottesville, VA	67,553	1	0	2
	Danville, VA	54,315	1	0	2
	Fredericksburg, VA	56,718	1	0	3
	Kingsport, TN—VA	4,229	2	0	1
	Lynchburg, VA	98,138	1	0	4
VT	Burlington, VT	87,088	4	4	1
WA	Bellingham, WA	59,317	1	0	1
	Bremerton, WA	112,977	2	0	1
	Longview, WA—OR	54,985	2	0	1
	Olympia, WA	95,471	3	0	1
	Richland—Kennewick—Pasco, WA	116,118	4	0	2
	Spokane, WA	279,038	2	0	1
	Yakima, WA	88,054	3	0	1
WI	Appleton—Neenah, WI	160,918	7	8	3
	Beloit, WI—IL	42,705	1	3	1
	Duluth, MN—WI	27,615	2	0	1
	Eau Claire, WI	80,293	3	7	2

Table 3-9. List of Urbanized Areas Not Associated With a Phase I Municipality (continued)

State	Urbanized Area	Total Population	No. of Incorporated Places	No. of Minor Civil Divisions	No. of Counties
WI	Green Bay, WI	161,931	5	4	1
	Janesville, WI	52,995	1	3	1
	Kenosha, WI	94,292	2	2	1
	LaCrosse, WI—MN	74,203	3	4	1
	Oshkosh, WI	58,935	1	4	1
	Racine, WI	121,788	5	2	1
	Round Lake Beach—McHenry, IL—WI	53	0	1	1
	Sheboygan, WI	61,012	3	4	1
	Wausau, WI	57,352	3	3	1
WV	Charleston, WV	164,418	14	0	3
	Cumberland, MD—WV	3,007	1	0	1
	Huntington—Ashland, WV—KY—OH	79,681	4	0	2
	Parkersburg, WV—OH	51,843	3	0	1
	Steubenville—Weirton, OH—WV—PA	29,871	2	0	2
	Wheeling, WV—OH	59,252	8	0	2
WY	Casper, WY	52,248	3	0	1
	Cheyenne, WY	61,890	1	0	1

[1] Puerto Rico does not use the designations of "incorporated place," "minor civil division," or "county" for any of its municipalities; therefore the table has been left intentionally blank under these headings.

Table 3-10. Urbanized Areas Without a Municipality in Phase I of the NPDES Storm Water Program

Urbanized Area Population	Number of Urbanized Areas	Incorp. Places	Minor Civil Divisions	Counties	Total Population
50,000 - 74,999	114	287	162	159	6,954,446
75,000 - 99,999	54	156	122	83	4,690,007
100,000 - 124,999	36	132	82	43	4,050,106
125,000 - 149,999	12	48	38	9	1,639,209
150,000 - 249,999	30	191	177	39	5,621,799
Over 250,000	23	656	385	47	20,008,804
TOTALS	269	1,470	966	380	42,964,371

Table 3-11. Urbanized Areas With a City With a Population of 100,000 or More but Without a Phase I Municipality

Urbanized Area	Urbanized Area Population	Core City	Core City Population	Population Served by Combined Sewer *
Albany—Schenectady—Troy, NY	509,106	Albany	101,082	96,500
Bridgeport—Milford, CT	413,863	Bridgeport	141,686	50,000
Buffalo—Niagara Falls, NY	954,332	Buffalo	328,123	328,123
Chicago, IL—Northwestern Indiana	6,792,087	Chicago	2,783,726	2,783,726
Erie, PA	177,668	Erie	108,718	108,719
Evansville, IN—KY	183,087	Evansville	126,272	50,425
Hartford-Middletown, CT	546,198	Hartford	139,739	110,000
Lansing—East Lansing, MI	265,095	Lansing	127,321	50,000
New Haven—Meriden, CT	451,486	New Haven	130,474	84,300
Peoria, IL	242,353	Peoria	113,504	77,000
Pittsburgh, PA	1,678,745	Pittsburgh	369,879	369,879
Ponce, PR	190,079	Ponce	159,151	NA **
Providence—Pawtucket, RI—MA	846,293	Providence	160,728	160,728
Rochester, NY	619,653	Rochester	231,636	231,636
San Juan, PR	1,221,086	San Juan	426,832	NA **
Santa Rosa, CA	194,560	Santa Rosa	113,313	0
South Bend—Mishawaka, IN—MI	237,932	South Bend	105,511	100,000
Spokane, WA	279,038	Spokane	177,196	135,600
Springfield, IL	124,524	Springfield	105,227	75,000
Springfield, MA—CT	532,747	Springfield	156,983	156,983
St. Louis, MO-IL	1,946,526	St. Louis	396,685	396,685
Syracuse, NY	388,918	Syracuse	163,860	140,800
Waterbury, CT	175,067	Waterbury	108,961	99,947

* Population served by combined sewers within the core city of the urbanized area.

** Information on combined sewers in Puerto Rico not available.

3.1.3.3 Urban Populations Outside of Urbanized Areas

The Bureau of the Census defines urban populations to consist of persons living in any densely settled place of 2,500 or more inhabitants. Urban populations outside of urbanized areas are comprised of distinct population centers of more than 2,500 but less than 50,000 people. The total urban population outside of urbanized areas is 29.0 million people. Of this total, 25.1 million people live in 3,689 incorporated places. The remaining 3.9 million people live in either minor civil divisions or unincorporated portions of counties. The urban population outside of urbanized areas but inside a metropolitan areas as defined by OMB is 10.8 million.

3.1.3.4 Rural Populations

The census population data base classifies any population other than urban populations as rural populations. In 1990, the rural population totalled 61.5 million people. Of this total, 8.8 million live in 13,044 incorporated places; the remaining 52.7 million people live in either minor civil divisions or unincorporated portions of counties.

3.1.3.5 Populations Not Addressed in Census

The census data does not address certain classes of development, including resort towns and second home development. The census population data base generally does not reflect seasonal populations, such as people that only live in a resort town during peak seasons, second home development, people staying in rental units, or tourists. For example, on some peak weekends, more than 250,000 people may visit Ocean City, Maryland. According to the census, however, the permanent population of Ocean City, Maryland, is only 5,146. It has been estimated that more than two-thirds of recreational subdivisions are situated near water, often on artificially constructed lakes (Reilly, *The Use of Land*, 1973).

3.1.4 Development Trends

New development is widely recognized as providing some of the best opportunities for implementing cost-effective storm water management controls. This section identifies major trends of new development.

During the twentieth century, the U.S. population has become increasingly urbanized. The rate of growth occurring over the last four decades is exemplified by Bureau of the Census data on urbanized areas with a population of 50,000 or more. Table 3-12 shows two important trends that have occurred since 1950:

- The total populations in urbanized areas have been rapidly increasing.
- Most of this growth has been occurring outside larger central cities in urban fringe areas.

Table 3-12. Growth of Urbanized Areas in the United States Between 1950 and 1990

Year	Number of Urbanized Areas	Population in Urbanized Areas (millions)			Land Area (sq.mi.)
		Total	Central Cities	Urban Fringe	
1950	157	69.2	48.4	20.9	19,728
1960	213	95.8	57.9	37.8	25,544
1970	273	120.7	65.1	55.6	35,081
1980	366	139.2	67.0	72.1	52,017
1990	405	160.4	79.7	80.7	61,520

Source: Bureau of the Census, U.S. Dept. of Commerce

Between 1980 and 1990, the population of Census-designated urbanized areas increased by 21.2 million[8] and the cumulative size increased by 9,000 square miles. During the same period, the rural population of the United States increased by 2.2 million, and the urban population that lived outside of urbanized areas increased by 0.9 million.

[8] About 7 percent of this increase (1.5 million people) is associated with the net addition of 30 new urbanized areas between 1980 and 1990. Another part of this increase which has not been estimated here is associated with the increase in land area of pre-existing urbanized areas.

Cities with a population of 100,000 or more with municipal systems already addressed by Phase I of the NPDES storm water program increased in population by about 4.9 million people (or an increase of 9 percent) between 1980 and 1990.[9] Between 1980 and 1990, the population of urbanized areas with one or more municipal systems addressed by Phase I of the NPDES storm water program increased by 16.4 million (or 67 percent of the total national growth). This represented a 25 percent increase in the population of these areas. The population of urbanized areas without a Phase I municipal system increased by 4.8 million. This represents 20 percent of the total national growth and an 11 percent increase in the population of these areas.

Population increase is only one indicator of new development. Significant development can occur, particular in some of the larger urbanized areas experiencing migration from core cities to suburban areas. For example, between 1970 and 1990, the total population of the Chicago urbanized area was relatively stable, increasing by only 77,509 people. However, during this time significant migration was occurring from the core city to surrounding suburban areas. The population of the city of Chicago decreased by 583,257 while the population of suburban areas increased by 660,766. The Chicago urbanized area increased in land area by 307 square miles, or by 25 percent of its 1970 size.

The migration away from central business districts to the suburbs has been occurring at high rates since the late 1970s. By the mid-1980s, approximately 57 percent of the office space in the country was located in the suburbs; before that time, central business districts within the urban core contained the majority of office space (Cooper, 1986).

Growth is concentrated in certain geographic regions of the country. For example, the most growth in urbanized areas is occurring mainly in the south and west. High rates of growth are occurring in coastal and estuarine areas. Population in these areas has increased

[9] The 4.9-million increase does not include increases associated with unincorporated, urbanized portions of Phase I counties and designated municipalities.

by about 30 million people during the last 3 decades (almost half the total U.S. population increase) and is expected to increase, although at reduced levels (Culliton et al., 1990). The Bureau of the Census projects that most growth by 2010 will occur on the Pacific, Atlantic, and Gulf Coasts (Figure 3-5). High growth areas include California and Washington State in the West, all of the coastal States south of New Jersey in the East, and Florida and Texas in the Gulf Coast region.

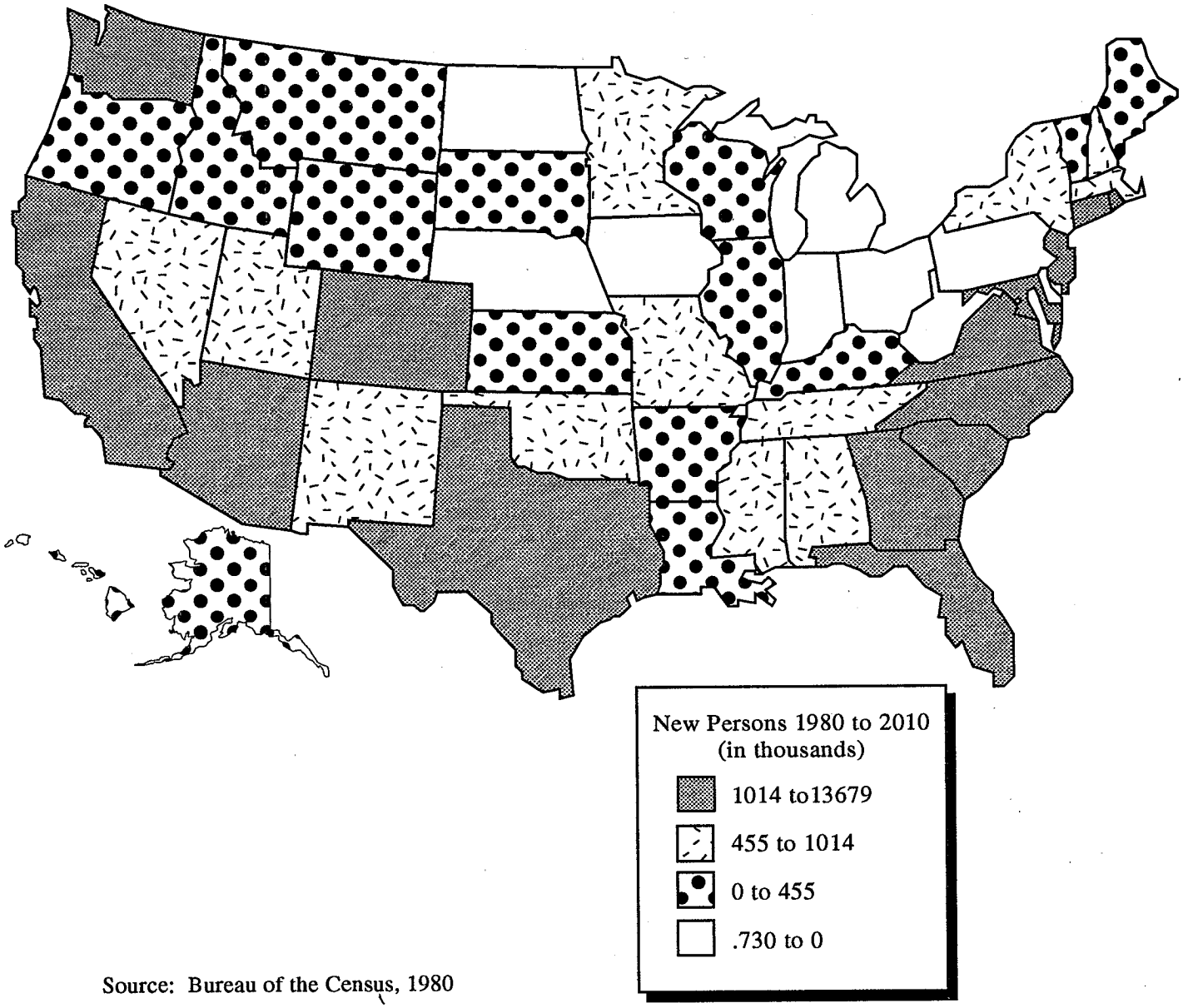
A comparison of 1990 census data to 1980 data supports these projections (Table 3-13). Twenty-five of 30 coastal States have seen dramatic population increases since 1980 (Bureau of the Census, 1991). The largest increases occurred in California (6.1 million people), Florida (3.2 million people), and Texas (2.7 million people). While the major population corridors extend from New York to Washington, DC, Los Angeles to San Diego, and within the San Francisco Bay metropolitan area, estuaries in the Middle Atlantic contain the greatest percentage of urban land and is the most densely populated among regions (NOAA, 1990).

3.2 NATURE OF DISCHARGES FROM MUNICIPAL SYSTEMS

A number of features of the urban environment affect the manner in which discharges from municipal separate storm sewers may affect surface water resources, including:

- Urban activities and sources that generate or contribute to pollutants
- Increased levels of imperviousness
- Modifications and destruction of natural drainage features, including removal of riparian vegetation
- Design objectives of drainage system.

The degree of impact on a receiving water can also depend on other factors, including the frequency and duration of the storm water discharges, the quality and quantity of storm water discharges, the occurrence of other wet weather discharges (e.g., combined sewer



Source: Bureau of the Census, 1980

Figure 3-5. Population Growth Forecast Between 1980 and 2010

Table 3-13. Total Resident Population by State: 1990 and 1980

1990 Total Population Rank	State	1990 Total Population	1980 Total Population	Number Change 1980 to 1990	Percent Change 1980 to 1990
1	California	29,760,021	23,667,902	6,092,119	25.7
2	New York	17,990,455	17,558,072	432,383	2.5
3	Texas	16,986,510	14,229,191	2,757,319	19.4
4	Florida	12,937,926	9,746,324	3,191,602	32.7
5	Pennsylvania	11,881,643	11,863,895	17,748	0.1
6	Illinois	11,430,602	11,426,518	4,084	0.0
7	Ohio	10,847,115	10,797,630	49,485	0.5
8	Michigan	9,295,297	9,262,078	33,219	0.4
9	New Jersey	7,730,188	7,364,823	365,365	5.0
10	North Carolina	6,628,637	5,881,766	746,871	12.7
11	Georgia	6,478,216	5,463,105	1,015,111	18.6
12	Virginia	6,187,358	5,346,818	840,540	15.7
13	Massachusetts	6,016,425	5,737,037	279,388	4.9
14	Indiana	5,544,159	5,490,224	53,935	1.0
15	Missouri	5,117,073	4,916,686	200,387	4.1
16	Wisconsin	4,891,769	4,705,767	186,002	4.0
17	Tennessee	4,877,185	4,591,120	286,065	6.2
18	Washington	4,866,692	4,132,156	734,536	17.8
19	Maryland	4,781,468	4,216,975	564,493	13.4
20	Minnesota	4,375,099	4,075,970	299,129	7.3
21	Louisiana	4,219,973	4,205,900	14,073	0.3
22	Alabama	4,040,587	3,893,888	146,699	3.8
23	Kentucky	3,685,296	3,660,777	24,519	0.7
24	Arizona	3,665,228	2,718,215	947,013	34.8
25	Puerto Rico	3,522,037	3,196,520	325,517	10.2
26	South Carolina	3,486,703	3,121,820	364,883	11.7
27	Colorado	3,294,394	2,889,964	404,430	14.0
28	Connecticut	3,287,116	3,107,576	179,540	5.8
29	Oklahoma	3,145,585	3,025,290	120,295	4.0
30	Oregon	2,842,321	2,633,105	209,216	7.9
31	Iowa	2,776,755	2,913,808	-137,053	-4.7
32	Mississippi	2,573,216	2,520,638	52,578	2.1
33	Kansas	2,477,574	2,363,679	113,895	4.8
34	Arkansas	2,350,725	2,286,435	64,290	2.8
35	West Virginia	1,793,477	1,949,644	-156,167	-8.0
36	Utah	1,722,850	1,461,037	261,813	17.9
37	Nebraska	1,578,385	1,569,825	8,560	0.5
38	New Mexico	1,515,069	1,302,894	212,175	16.3
39	Maine	1,227,928	1,124,660	103,268	9.2
40	Nevada	1,201,833	800,493	401,340	50.1
41	New Hampshire	1,109,252	920,610	188,642	20.5
42	Hawaii	1,108,229	964,691	143,538	14.9
43	Idaho	1,006,749	943,935	62,814	6.7
44	Rhode Island	1,003,464	947,154	56,310	5.9
45	Montana	799,065	786,690	12,375	1.6
46	South Dakota	696,004	690,768	5,236	0.8
47	Delaware	666,168	594,338	71,830	12.1
48	North Dakota	638,800	652,717	-13,917	-2.1
49	District of Columbia	606,900	638,333	-31,433	-4.9
50	Vermont	562,758	511,456	51,302	10.0
51	Alaska	550,043	401,851	148,192	36.9
52	Wyoming	453,588	469,557	-15,969	-3.4
53	Guam	133,152	* 107,000	* 26,000	* 24.2
54	Virgin Islands	101,809	* 98,000	* 4,000	* 4.1
55	American Samoa	46,773	* 32,000	* 15,000	* 47.9
56	North. Mariana Islands	43,345	* 17,000	* 26,000	* 152.9

* Estimated 1980 census populations

overflow discharges), and the quantity and quality of the base flow (dry weather flow) of the stream. Appendix B further discusses the potential impacts from storm water discharges to different classes of receiving waters.

3.2.1 Major Pollutant Sources

Pollutants in discharges from municipal separate storm sewer systems originate from a variety of diffuse sources. This subsection discusses both runoff-related and non-storm water sources of pollutants.

3.2.1.1 Runoff-Related Pollutant Sources

The urban environment has many sources that can contribute pollutants to storm water. Table 3-14 provides selected examples of the major common sources of pollutants in the urban environment. Many of these sources, such as those related to vehicles, building materials, and road maintenance, are ubiquitous in the urban environment. The complex interactions of the various pollutant sources in the urban environment have limited efforts to quantify the contribution of pollutants from specific sources. Rather, most studies of the quality of urban runoff have characterized pollutant concentrations in runoff from general land use categories (e.g., residential, commercial, open land). However, several recent studies have begun to look at smaller segments of the urban environment that may generate runoff with elevated levels of pollutants.[10] At least one recent study has attempted to evaluate the contribution of pollutants from different formulations of a commercial product (brake pads) to urban runoff.[11] Another recent study addressing deposition of air pollutants to waters identified fossil fuel combustion in industrial, commercial, and residential units;

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[10] For example, see Bannerman, R., et al., 1993 *Sources of Pollutants in Wisconsin Stormwater*, Water Science & Technology (28): 3-5, pp. 241, which indicates that streets and roads may be the most significant source of pollutants associated with residential, commercial and industrial land use. Pitt, R., et al. *The Treatability of Urban Stormwater Toxicants*, International Congress on Integrated Stormwater Management, 1991, which reported that runoff from vehicle service areas and parking lots generally had higher concentrations of polynuclear aromatic hydrocarbons and metal than runoff from street surfaces. In addition, a higher frequency of runoff from vehicle service areas and parking lots exhibited toxicity.

[11] See Public Review Draft of *Contribution of Heavy Metals to Storm Water from Automotive Disc Brake Pad Wear*, Santa Clara Valley Nonpoint Source Pollution Control Program, 1994.

Table 3-14. Common Pollutants and Non-Industrial Pollutant Sources Associated With Urban Runoff

Pollutant	Source (Category: Components)
Lead	Vehicles: exhaust, tire wear (filler material), lubricating oil and grease Structures and roads: paint
Zinc	Vehicles: tire wear (filler material), oil and grease (stabilizing additive), brake pads, metal corrosion Paved surfaces: deicing salts Structures: paint, metal corrosion, wood preservatives
Copper	Vehicles: parts wear (brakes, metal plating, bearings and bushings), diesel fuel Structures: paint, metal corrosion, wood preservative Other: pesticides
Cadmium	Vehicles: tire wear (filler material) Other: pesticides
Chromium	Vehicles: parts wear (brakes, metal plating, engine parts)
Nickel	Vehicles: diesel fuel, lubricating oil, parts wear (brakes, metal plating, and bushings) Paved surfaces: asphalt
Manganese	Vehicles: parts wear (engine parts)
Bromide	Vehicles: exhaust
Mercury	Other: coal combustion Vehicles: fuel combustion Structures: paint
Iron	Vehicles: body rust, engine wear Structures: rust
Cyanide	Paved surfaces: deicing salts Structures: wood preservatives
PAHs	Vehicles: exhaust Other: incomplete combustion
Chloride	Paved surfaces: deicing salts
Sulphates	Other: combustion product Vehicles: exhaust Paved surfaces: road beds, deicing salts
Nitrogen, Phosphorus	Vehicles: exhaust Other: combustion product Landscape maintenance: fertilizers Soil erosion: land disturbance, exposed soils Sewage: leaking sanitary systems, septic systems

Sources: EPA, 1992, 1990, 1983; Kobriger et al., 1984.

Table 3-14. Common Pollutants and Non-Industrial Pollutant Sources Associated With Urban Runoff (continued)

Pollutant	Source (Category: Components)
Sediments, Particulates	Soil erosion: land disturbance, exposed soils Streambank erosion: high flows Vehicles: body rust, tire wear, other wear
Pesticides	General outdoor application Structures: wood preservatives, paint
Floatables	Litter: residential, commercial, industrial, recreation Waste disposal: residential, commercial, industrial recreation Vegetation: leaves, branches, trunks
Bacteria	Sewage: leaking sanitary systems, septic systems Other: animal droppings Soil erosion: exposed soils
Oil and grease	Vehicles: drippings, leaks Paved surfaces: asphalt Equipment maintenance: exposed surfaces Other: wood preservatives, wood/coal combustion
PCBs	Vehicles: catalyst in synthetic tires Other: electrical, insulation
Benzene	Vehicles: fuel Other: solvent use
Toluene	Vehicles: fuel and asphalt Other: solvent use
Chloroform	Vehicles: form by mixing salt, gasoline and asphalt
Oxygen Demand	Vegetation: leaves Litter: various sources Soil erosion: land disturbance, exposed soils
Phthalate, bis(2-eth.)	Structures: plasticizer Other: plasticizer

Sources: EPA, 1992, 1990, 1983; Kobriger et al., 1984.

municipal waste combustion and hazardous waste and sewage sludge incineration; and various manufacturing processes, such as cement production as major local sources of metals. The report also identified fossil fuel and biomass combustion in petroleum refineries, motor vehicles, and industrial commercial and residential units as major local sources of polycyclic organic matter.

A number of the sources provided in Table 3-14 are related to materials exposed to precipitation. Examples of these sources include zinc from galvanized gutters and roofs and lead from certain exterior paints. Other sources are generally released to the environment, such as metals and polynuclear aromatic hydrocarbons (PAHs) in automobile emissions, zinc in tire wear, and emissions from industrial sites. Pollutants from these sources can be carried away from their original point of generation and accumulate on other impervious surfaces where they are eventually washed off. In addition, erosion of land and streambanks can contribute sediments and other pollutants.

Pollutant concentrations in runoff from different land uses are discussed below.

3.2.1.2 Non-Storm Water Sources

Although separate storm sewers are primarily designed to remove runoff from storm events, materials other than storm water end up in and are ultimately discharged from separate storm sewers. For example, in Sacramento, California, it is estimated that less than half of the water discharged from the storm water drainage system is directly attributed to precipitation.[12] Non-storm water discharges to storm sewers come from a variety of sources,[13] including:

- Illicit connections and cross connections from industrial, commercial, and sanitary sewage sources
- Leaking sanitary sewage systems
- Malfunctioning onsite disposal systems (septic systems)
- Improper disposal of wastes such as used oil, wastewaters, and litter

[12] *Urban Runoff Discharge from Sacramento, CA*, Montoya, B., CA Regional Water Control Board, Central Valley Region, 1987, Report Number 87-1SPSS.

[13] A more complete description of non-storm water discharges to storm sewers is given in *Investigation of Inappropriate Pollutant Entries into Storm Drainage Systems: A User's Guide*, EPA, January 1993, EPA/600/R-92/238.

- Spills
- Infiltration of ground water contaminated by a variety of sources, including leaking underground storage tanks
- Wash waters, lawn irrigation, and other drainage sources.

Appendix C provides a more complete description of these sources of non-storm water. Table 3-15 summarizes numerous studies involving problems with non-storm water discharges. These case studies illustrate the wide range of pollutants (e.g., pathogens, metals, nutrients, oil and grease, phenols, and solvents) that can be contributed to storm sewers from non-storm water discharges. Removal of these non-storm water sources of pollutants often provides opportunities for dramatically improving the quality of discharges from separate storm sewers and is required by Section 402(p)(3)(B)(ii).

Table 3-15. Summary of Non-Storm Water Discharge Problems

Study Site	Comments
Jones Falls Watershed Baltimore City and County, MD	During the NURP study of the Jones Falls Watershed, 15 illicit connections were discovered in portions of the watershed. The illicit connections were grouped into four types: direct discharges from residences, leakage from cracked or broken sewer lines, decades-old overflows from the sanitary sewer, and sanitary sewage pumping station malfunctions. Elevated levels of pathogens, TSS, ammonia, TKN, total nitrogen, COD, and TOC were identified.
Tulsa, Oklahoma	A physical inspection was conducted on 120,000 feet of storm sewer 48 inches and larger serving a drainage area of approximately 12 square miles. 35 potential non-storm water discharges were observed. 23 of these were observed and/or suspected sanitary sewer connections, 4 were potable water discharges, and 8 were of an unknown source. In addition, 12,900 feet of sanitary sewer were laid within the storm sewer where the storm sewer served as a conduit. Most illicit connections were associated with development that occurred before 1970. Other documented observations were structural defects (900 feet of pipe showed signs of structural defects), pipe cross through (176 total), and debris buildup.

Table 3-15. Summary of Non-Storm Water Discharge Problems (continued)

Study Site	Comments
Washtenaw County, MI	Of the 1,067 businesses, homes, and other buildings inspected, 154 of the buildings inspected (14%) had illicit connections, including connections in restaurants, dormitories, car washes, and auto repair facilities. About 60% of the automobile-related businesses inspected had illicit discharges. A majority of the illicit connections discovered had been approved connections when installed. Pollutants that were detected include heavy metals, nutrients, TSS, oil and grease, radiator fluids, and solvents.
Fort Worth, TX	24 outfalls in a 10-mile radius were targeted for end-of-pipe observations. The success of the program was judged by a decline in the number of undesirable features at the target outfalls, from an average of 44 undesirable observations per month in 1986 (522 total) to an average of 21 undesirable observations per month in 1988. The Fort Worth investigation indicated problems associated with allowing septic systems, self-management of liquid waste by industry, and construction of municipal overflow bypasses from the sanitary sewer to the storm drains. These problems were attributed to the inability of the POTW to expand as rapidly as urban growth occurred. During a 30-month period, problems detected include 133 hazardous spills, 125 incidents related to industrial activity, 265 sanitary sewer line breaks, and 21 bypass connections of the sanitary sewer to the storm sewer. Highlighted cases include a 20 gallon-per-minute flow from a cracked sanitary sewer from a bean processing plant to a storm drain and an illicit connection of a sanitary sewer line from a 12-story office building to a storm sewer. Most industrial pollution enters the storm sewer system from illegal dumping, storm runoff, accidental spills, and direct discharges. Metals were not detected in dry-weather discharges but were found in significant levels in receiving water sediment. City officials state that the high metal concentrations in sediment are consistent with otherwise unexplained serious reported fish kills.
Seattle, WA	The city of Seattle has detected improper disposal and illicit connections from industrial sites by investigating sediment in storm sewers. One storm drain outfall that represented a major source of lead to the Duwamish River was traced back to a former smelter that crushed batteries to recover lead. Lead concentrations in the sediment were high enough to allow the city to send it to an operating smelter to be refined. Another storm drain contained high levels of creosote, pentachlorophenol, copper, arsenic, and PCBs, which (except for the PCBs) were traced back to a wood treatment facility. Thirty cubic yards of contaminated sediments removed from the storm drain contained 145 pounds of contaminants. Sediments removed from storm drains in another industrial area contained very high levels of PCBs (about 1 pound of PCBs in 70 cubic yards of sediment).
Upper Mystic Lake, NY	The NURP study for the Upper Mystic Lake Watershed project identified contamination of storm water runoff and, subsequently, surface water contamination of surface waters by sanitary discharges as a major problem in the watershed that contributed large quantities of phosphorus, certain metals, and bacteria. Interactions at 19 manholes serving both sanitary and storm sewer lines were identified as the major contributor of pollutants.

Table 3-15. Summary of Non-Storm Water Discharge Problems (continued)

Study Site	Comments
Bellevue, WA	The NURP report for Bellevue, WA, recorded 50 voluntary citizen reports of illegal dumping and other non-storm water discharges during a 27-month period. The incidents reported were varied and resulted in at least two significant fish kills. 25 percent of the citizen reports involved improper disposal of used oil to the storm sewer. Other reports involved spills, illicit connections of floor drains, septic system pipes, and a car wash, as well as chemical dumping and concrete trucks rinsing out into catchbasins or streams.
Ann Arbor, MI	Studies in 1963, 1978, and 1979 found that discharges from the Allen Creek storm drain contained significant quantities of fecal coliform, fecal streptococci, solids, nitrates, and metals. Of the 160 businesses dye-tested, 61 (38%) were found to have improper storm drain connections. Chemical pollutants, including detergents, oil, grease, radiator wastes, and solvents, were causing water quality problems. Monitoring of the storm drainage system during storm events indicated a decrease in the concentration of 32 of 37 chemicals monitored after the improper connections were removed.
Medford, OR	Fecal coliform tests at storm drain outfalls in city parks were used to detect 4 leaking sanitary sewer lines that were either located above the storm lines or saturated the ground with effluent, which entered the nearby storm drains; an agricultural equipment wash rack; and a house with sanitary lines plumbed to the storm drain. In addition, in one of the oldest sections of town, a large storm drain bored in the early 1900s also contained the sanitary sewer line. Under manholes, the sanitary line was only a trough. Even minor clogs or breaks resulted in a spillover of effluent into the storm drain below.
Toronto, Ontario*	Dry weather samples of discharges were taken from 625 storm drains in the Humber River watershed. About 10 percent of the outfalls were considered significant sources of nutrients, phenols, and/or metals, while 30 of the outfalls had fecal coliform levels of greater than 10,000 per 100 ml. Investigations identified 93 industrial and sanitary sewage illicit connections. Problems included residential connections of sanitary sewage to the storm sewers and yard runoff from a meat packing plant to a storm drain.
Grays Harbor, WA	Dry weather sampling of 29 outfalls of separate storm drains indicated that discharges from 6 of the outfalls had abnormally high pollutant levels with suspected illicit connections. The area under consideration had originally been served by combined sewers. Earlier efforts to separate the system had been incomplete, with some residences discharging sanitary sewage to the storm drain.
Seward, NY	Sewage from septic systems with clogged drainfields in clay soils flowed into open storm sewers. The open storm sewers posed health risks to neighborhood children and lowered property values.

Table 3-15. Summary of Non-Storm Water Discharge Problems (continued)

Study Site	Comments
Norfolk Naval Station, VA	The Norfolk Naval Shipyard was originally built in 1767 and has had numerous additions since. It has an extensive network of underground pipes, including both separate storm sewers and sanitary/industrial sewers. In response to a lawsuit, officials at the Shipyard conducted dye-testing of sanitary facilities throughout the shipyard, which led to the identification and elimination of 25 cross-connections of sanitary and industrial waste to the separate storm sewer system.
Sacramento, CA	The city of Sacramento is currently undertaking a project to identify pollutant discharges and illegal connections to the storm water drainage systems. Recent studies identified acute toxicity in storm water and determined that less than half of the water discharged from the drainage system was not directly attributable to precipitation. Mass loading estimates of copper, lead, and zinc discharged by the drainage system were several times higher than the estimated pollutant loads of these metals from the Sacramento Regional Treatment Plant secondary effluent.
Hazardous Waste Case Studies	These case studies determined that onsite waste disposal where pollutants were added to runoff, eventually ending up in drainage systems, and other situations where a generator dumped wastes directly down a drain were common. Of the 36 cases of illegal dumping investigated in a GAO report, 14 cases investigated involved disposal of hazardous wastes directly to, or with drainage to, a storm sewer, flood control structure, or the side of a road. An additional 10 sites involved disposal to the ground, to landfills (other than those receiving hazardous wastes), or to trash bins, which can ultimately result in additional pollutants to subsequent storm water discharges.

* Information from cities outside of the United States included for informational purposes only.

3.2.2 Imperviousness

The level of watershed imperviousness can be linked to impacts to streams and other surface water resources (Schueler et al.). Urbanization and development increase the imperviousness of land, which alters the natural vegetation and infiltration characteristics of watersheds. These increases in imperviousness can dramatically alter natural flow patterns of streams, wetlands, and other surface water resources. Increased levels of imperviousness replace natural vegetation and decrease the natural infiltration characteristics of a watershed, increasing the amount of runoff during wet weather events. Schueler estimates that in undeveloped watersheds, 5 to 15 percent of the annual stream flow is delivered during storm events. As a general rule, the amount of runoff occurring during storm events is directly proportional to the amount of watershed imperviousness. For example, runoff from storm

events will typically comprise half the annual stream flow in a watershed that is 50 percent impervious (Schueler, 1987). Figure 3-6 illustrates how storm water peak flows increase as population (and, consequently, imperviousness) increases based on data from the United States Geological Survey (USGS) and the Bellevue Planning Department (1977). In addition to causing increased flooding, changes in the hydrology of a stream can result in accelerated stream bank or stream bed erosion. Such erosion can cause or contribute to a number of generally detrimental effects on stream hydrology and morphology. For example, erosion can widen or deepen the stream channel, eliminate pools and other structures in the stream, and shift gravel or sand bars (Schueler, 1992).

Increased levels of imperviousness also cause less infiltration of rainfall to recharge ground water supplies, thereby lowering the water table. One result of lowered water tables is that baseline stream flows can be significantly decreased during dry weather. Reduced flows between storms may significantly affect the aquatic habitat and the ability of a stream to dilute toxic spills or other dry weather pollutants within the stream system (Bellevue NURP project). In some cases, the installation of storm sewers in a watershed results in previously perennial streams running dry several times a year (Long Island NURP project).

The level of watershed imperviousness is probably the most significant factor affecting pollutant loadings in runoff from many land uses, including residential and commercial areas (NURP, EPA 1984). Increasing imperviousness increases runoff volumes, which, in turn, increase pollutant loads. Increased imperviousness can also increase stream temperatures, resulting in adverse effects on cold water habitats. Moreover, increased imperviousness can result in decreases in fish diversity (Schueler and Galli, 1992).[14]

[14] For more information on the relationship of watershed imperviousness and biological quality see Jones and Clark, 1987; Klein, 1979; Limburg and Schmidt, 1990; Pedersen and Perkins, 1986; and Booth and Jackson, 1994.

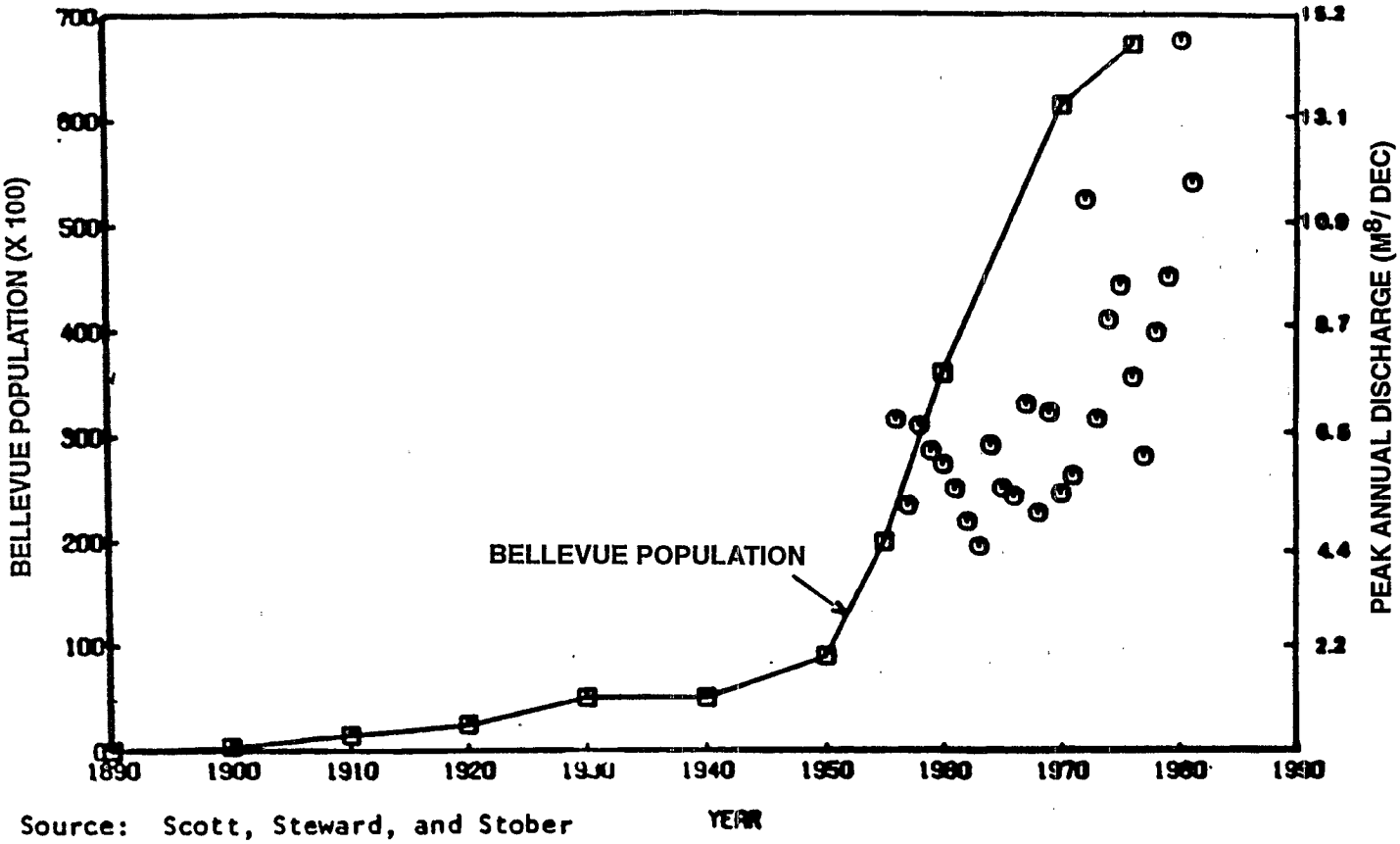


Figure 3-6. Population of Bellevue and Peak Annual Discharge in Kelsey Creek. Data From USGS and Bellevue Planning Dept., 1977

3.2.3 Modification of Natural Stream Channels and Riparian Vegetation

During the process of development, the natural drainage system (e.g., streams, wetlands, and other receiving waters) and surrounding vegetation is often modified. Streams can be diverted through underground culverts or channelized. Wetlands can be drained or filled, reducing the natural capacity of the drainage systems to dampen peak flows associated with storm events. After development has occurred, the natural drainage system is often unable to handle the higher volume of flows. The higher volume of flows can result in high stream bank and stream bed erosion rates or flooding. Drainage systems that have undergone these changes often need additional engineered modifications downstream, such as channelization or lining projects or direction of streams through underground culverts.

Removal of riparian vegetation, coupled with increased watershed imperviousness, can result in significant increases in water temperatures. Such changes can reduce or eliminate sensitive stream insects and fish species. Modification of riparian vegetation can also have significant impacts on stream habitat value.[15]

3.2.4 Design Objectives of Drainage System

The manner in which a storm sewer system is installed, and its design objectives, affect the quality and quantity of the storm water discharge, as well as the potential presence of non-storm water discharges. The historical development of storm sewers can be characterized in terms of four overlapping time periods. A description of storm water management during these periods shows how some of the water quality problems associated with storm sewer discharges have come about.[16]

1800-1850	The first storm sewers were installed primarily to reduce flooding and ponding. Sanitary sewage connections resulted when adequate sanitary sewers were not provided.
1850-1950	In some municipalities, combined sewers designed to carry both storm water and sanitary sewage were installed.
1900-Present	In other municipalities, separate systems were installed for sanitary and storm sewers. Storm sewers were designed to provide for the rapid removal of storm water runoff from a site.
1970-Present	Some communities begin to address storm water as a resource to be used to recharge ground water and to supply fresh water to surface waters. In addition, properly managed storm water avoids problems with erosion, flooding and adversely impacting natural drainage features such as streams, wetlands and lakes. The multiple goals of water quality and water quantity are addressed when managing storm water.

[15] For a more detailed discussion of the relationship between streams and the hyporheic zone, the area that is biologically and hydrologically connected to the surface water of a system, see *Entering the Watershed, A New Approach to Save America's River Ecosystem*, Doppet, B. et al., 1993.

[16] NURP - Ann Arbor, MI Report, 1984, and *Water and the City: The Next Century*, Rosen and Keating, American Public Works Association, 1991.

3.2.4.1 Early Sewers (1800-1850)

The oldest urban storm sewers in the United States date back to the early 1800s. Ponding of surface waters, coupled with poor sanitary conditions in urban areas, led to the installation of these early storm sewers to provide drainage. Little is known of the early storm sewers, as they were constructed by individuals or small districts at their own expense with little or no engineering or public supervision. Early storm sewers preceded the development of sanitary sewers. Once these early storm sewers were in place, they received wastes from other sources, some from direct connections of ditches and pipes to the storm sewers and others from materials dumped into the streets or storm sewers. Wastes which ended up in storm sewers included house wastes (most buildings lacked indoor plumbing), cesspool overflows, garbage, and excrement from horses and livestock. These practices created health and aesthetic problems, as storm sewers were often oversized on a flat grade, resulting in accumulation of sewage in storm sewers during dry weather. Wastes which accumulated during dry weather were then discharged into receiving streams during rain events. Many cities prohibited the discharge of domestic sewage to storm sewers but failed to provide public sanitary sewers, resulting in secret connections built without public supervision. Other illegal connections to the storm sewer were often overlooked by municipal officials because of the lack of proper sanitary sewers (NURP, 1984) (APWA, 1991).

3.2.4.2 Combined Sewers (1850-1950)

By the second half of the 19th century, combined sewer systems, designed to carry both sanitary sewage and storm runoff, were being installed to limit the costs associated with separate systems. At the time, these systems were chosen over separate systems because of their lower costs, even though it was known that separate systems were preferred on the basis of sanitary conditions. By 1875, although 67 cities in the United States with populations of greater than 100,000 had combined sewer systems, none treated waste before discharging it to the nearest receiving water body. In many cities, streams were covered to minimize the resulting nuisance. Pollution and health problems forced the expensive

installation of interceptors to collect dry weather flows from hundreds of combined sewer outlets for conveyance or pumping to treatment plants prior to discharge.

As cities expanded, storm runoff and sewage flows increased. Combined interceptors which had been installed prior to expansion could not handle increases in flow to the point that even modest rain events could cause flooding of streets and basements. Combined sewer overflows (CSOs) that discharged storm water and sewage directly to surface waters were installed to minimize flooding problems, including sewage backing up into the basements of commercial and residential buildings. These systems bypassed treatment and the general sanitary quality of receiving waters again deteriorated (NURP, 1984) (APWA, 1991).

3.2.4.3 Separate Sewers for Water Removal (1900-Present)

The first large scale sewer system to provide separate collection of storm runoff and sanitary sewage was built in 1880 in Memphis, TN, although the construction of combined systems was continued and extended in most major cities. As early as 1900, many State regulatory agencies would not permit further construction of combined sewers. Where water quality impacts from CSOs were extreme, some cities implemented programs to separate portions of the older combined system.

Problems arose with separate storm water and sewage systems. As city populations increased, the demand for sewer service increased. However, sewer mains, interceptors, pumping stations and treatment plants were slow to grow. The post-World War II boom for sewer service into fast growing suburban areas was often associated with high infiltration rates and many illegal rain water connections which overloaded the system during rain events. To limit raw sewage backups in basements, hundreds of connections were made to bleed sewage from the sanitary sewers to the storm drains to limit flows in the sanitary sewers. Improper connections of grey waters such as automobile repair shop floor drains were either encouraged or implicitly allowed to discharge to storm drains.

Other problems arise with separate storm sewers, as storm water management often focuses on the rapid removal of storm water runoff from a site. The assumption is that problems will disappear after storm water leaves the site. Under this approach, which usually involves concrete channels and underground piping networks, storm drains are constructed without regard for the control and slow release of storm water or for possible downstream effects. This approach to storm water management has been characterized by simplistic goals, rigid design standards (such as requiring piping for drainage instead of relying on natural drainage features), low engineering review costs, and high construction and maintenance costs. In some cases, flood problems are only shifted to downstream sites (NURP, 1984) (APWA, 1991).

3.2.4.4 Storm Water Management for Water Quantity and Water Quality Purposes (1970-Present)

A few communities have developed programs where storm water is managed for multiple purposes including controlling water quantity (to avoid flooding and stream scour and to maintain stream flows during dry weather by recharging ground water during storms) and improving water quality. A range of alternative storm water control measures and facilities can be implemented to serve multiple purposes effectively. The natural cycles and processes which occur prior to the development of the land are used as a guide for managing storm water after development has occurred. Natural flow patterns and rates of discharge are retained through special storm water control facilities and measures. Natural processes are incorporated into the design of many "soft" engineered systems, including vegetated buffers, greenways, revegetation of storm water systems, wetland creation or retention for storm water management, and onsite retention, detention or infiltration systems. Policies emerging from these programs include:

- Reducing peak flows and improving storm water quality by onsite retention
- Reducing the volume of storm water leaving the site by natural infiltration

- Releasing storm water from onsite facilities at a rate similar to the pre-development runoff rate
- Managing for smaller storm events as well as those larger storm events that can cause major floods
- Protecting wetlands and floodplains as natural storm water storage areas
- Making storm water facilities amenities of the development (such as retaining natural drainage channels or providing attractive landscaping for storm water management ponds) and encouraging open space and recreational uses
- Developing programs that relate erosion and sediment controls during construction with storm water management after construction is completed.

The implementation of this approach typically involves somewhat higher costs for development plan review by local governments, but lower costs for storm water facility construction, and results in reduced social costs (NURP, 1984) (APWA, 1991).

3.3 THE EXTENT OF DISCHARGES FROM MUNICIPAL SYSTEMS

3.3.1 Pollutant Concentrations of Runoff From Residential and Commercial Areas

Many studies have examined the nature of pollutants in municipal storm water discharges on a local level, but few have attempted to do so on a national level. The two most extensive assessments of pollutants in urban runoff are the Nationwide Urban Runoff Program (NURP) and information compiled in the USGS data base. These two data bases primarily reflect pollutant concentrations associated with runoff from residential and commercial areas.

From 1978 to 1983, EPA provided funding and guidance to NURP to provide a better understanding of the nature of urban runoff from residential and commercial areas. NURP included 28 projects that were conducted separately at the local level but were centrally reviewed, coordinated, and guided by EPA. Project locations across the country were selected by EPA to provide a range of types of receiving waters and beneficial uses, hydrologic characteristics, and urban characteristics.

The major focus of NURP was to characterize the water quality of runoff from residential, commercial, and industrial park sites. The NURP program evaluated data from 81 sites in 22 cities covering more than 2,300 separate storm events. Of the 81 sites selected, 39 were completely or primarily residential, 10 were commercial, 20 were mixed commercial and residential, 4 were industrial parks, and 8 were open spaces in urban areas. Because the industrial park category did not represent heavy industrial activity, the data from industrial parks were merged with commercial land use data. Each project was separate and distinct but shared common field monitoring protocols.

The NURP study provides insight on what can be considered background levels of pollutants for runoff from residential and commercial land uses. Sites evaluated in NURP were carefully selected so that they were not influenced by pollutant contributions from construction sites, industrial activities, or illicit connections. Several sites were eliminated from the study because of elevated pollutant loads associated with these or other sources.

NURP showed that the concentrations of pollutants in runoff from residential and commercial areas vary considerably from site to site. NURP postulated that the best general characterization of runoff from commercial and residential areas for planning purposes, where local information is lacking, can be obtained by pooling data from many sites.

The majority of samples collected under NURP were analyzed for seven conventional pollutants (biochemical oxygen demand, chemical oxygen demand, total suspended solids, total Kjeldahl nitrogen, nitrate plus nitrite, total phosphorus, and soluble phosphorus) and three metals (total lead, total copper, total zinc). Table 3-16 presents average discharge concentrations for these pollutants in runoff from the residential and commercial sites studied in NURP.[17]

[17] Recently, concerns have been raised regarding the validity and use of historical data for metals. As discussed in Chapter 2, EPA believes that historical data on storm water runoff from NURP and USGS are suitable for the purposes of this report.

Table 3-16. Summary of Event Mean Concentrations From NURP for Selected Pollutants

Constituent	Mean	Median Site	90th Percentile Site	Coefficient of Variability for Events
TSS (mg/l)	239	100	300	1-2
BOD (mg/l)	12	9	15	0.5-1
COD (mg/l)	94	65	140	0.5-1
Total P (mg/l)	0.50	0.33	0.70	0.5-1
soluble P (mg/l)	0.15	0.12	0.21	0.5-1
TKN (mg/l)	2.3	1.5	3.3	0.5-1
Nitrate plus nitrite (mg/l)	0.86	0.68	1.75	0.5-1
Total Cu (mg/l)	0.05	0.03	0.09	0.5-1
Total Pb (mg/l)	0.24	0.14	0.04	0.5-1
Total Zinc (mg/l)	0.35	0.16	0.50	0.5-1

In addition, the Section 307(a) priority pollutants were measured at 20 of the sites. Of the 119 pollutants analyzed, 77 were detected. All 13 metals on the priority pollutant list were detected, and all but 3 of the metals were detected at frequencies greater than 10 percent of the samples. Copper, lead, and zinc, found in at least 91 percent of the samples, were the most frequently detected metals. Of the 106 organic pollutants measured, 63 were detected. A plasticizer (bis (2-ethylhexyl) phthalate) and a pesticide (alpha-hexachlorocyclohexane (alpha-BHC)) were found in at least 20 percent of the samples analyzed. An additional 11 organic pollutants were reported at frequencies between 10 and 20 percent, including 4 pesticides, 3 phenols, 4 polycyclic aromatics, and a single halogenated aliphatic compound. NURP data also showed that during warm weather conditions, fecal coliform counts in urban runoff are typically in the tens to hundreds of thousands per 100 milliliters of runoff. Table 3-17 lists pollutants that were detected in 10 percent or more of the NURP samples.

Table 3-17. Priority Pollutants Detected in at Least 10 Percent of the NURP Samples

Pollutant	Detection Frequency (%)
Metals and inorganics	
Antimony	13
Arsenic	52
Beryllium	12
Cadmium	48
Chromium	58
Copper	91
Cyanides	23
Lead	94
Nickel	43
Selenium	11
Zinc	94
Pesticides	
Alpha-hexachlorocyclohexane	20
Alpha-endosulfan	19
Chlordane	17
Lindane	15
Halogenated aliphatics	
Methane, dichloro-	11
Phenols and cresols	
Phenol	14
Phenol, pentacholoro-	19
Phenol, 4-nitro	10
Phthalate esters	
Phthalate, bis(2-ethylhexyl)	22
Polycyclic aromatic hydrocarbons	
Chrysene	10
Fluoranthene	16
Phenanthrene	12
Pyrene	15

Source: EPA, 1983

The USGS has also collected urban rainfall, runoff, and water quality data nationally for several decades. In the mid-1980s, a data base containing information on 717 storms at 99 stations in 22 metropolitan areas throughout the United States (Driver et al., 1985) was compiled. The USGS examined a set of constituents similar to those compiled for NURP; the USGS also reported its data in terms of flow-weighted samples so that concentrations and loading values could be compared directly to NURP results. As described in Section 2.1.2.1 of this report, EPA compared information from the USGS data base to the findings from NURP.

In general, the findings between the two studies were very similar. Both data bases identified sediments and metals as the most significant pollutants measured. This determination is consistent with the findings of Driver and Lystrom (1986), who also compared the two data sets.

Two major trends related to automobiles that have occurred since the bulk of NURP data were collected are expected to affect urban runoff quality. The first trend involves the dramatic reductions in the levels of lead in gasoline. NURP data were generally collected during the time period when leaded gasoline was being phased out, and current concentrations of lead in runoff are expected to be generally lower than indicated by the NURP data.[18] Storm water monitoring data collected since that time tend to show a significant decrease in lead, but much less of a reduction then the percentage reductions of

[18] Tetraethyl lead has been extensively used as an inexpensive anti-knock, octane boosting gasoline additive since 1923. Aside from the Surgeon General temporarily suspending the production and sale of lead in gasoline in 1925, the use of lead in gasoline was largely unregulated until 1978. Decreases since that time are the result of two regulatory programs under the Clean Air Act (CAA): regulation of the amount of lead in leaded gasoline; and automobile emission standards resulting in new technology, catalytic converters, requiring the use of unleaded gasoline. Beginning in 1975, many automobile manufacturers began installing catalytic converters, which were poisoned by lead in gasoline, to meet emission standards. In 1978, EPA began to lower the level of lead in leaded gasoline under sections 211(c)(1) and (2) of the CAA to protect the public health and welfare and to safeguard the performance of emission control devices in general use. Most recently, EPA lowered the low-lead standard to 0.10 gplg, effective January 1, 1986, (March 7, 1985 (50 *FR* 9386)).

lead in gasoline. Other remaining sources of lead include industrial sources, paint, background levels in soil, and soil contaminated after 65 years of using lead in gasoline.[19]

The second trend pertains to the prohibition of the use of asbestos in brake pads and clutch linings. This is expected to result in a decrease in asbestos in runoff, which was not monitored in NURP, and an increase in copper and zinc, which are a substitute for asbestos in some brake pads.

3.3.1.1 Comparison of Pollutant Concentrations in Runoff from Residential/Commercial Areas to Discharges From Publicly Owned Treatment Works

The concentration of pollutants in runoff from residential and commercial areas (based on NURP and USGS data bases) can be compared to the typical concentration of pollutants found in the discharges from publicly owned treatment works (POTWs) that provide secondary treatment[20] (see Table 3-18). The concentration of total suspended solids (TSS) in runoff from residential and commercial areas is about an order of magnitude greater than the concentrations from POTWs receiving secondary treatment. The concentrations of COD, total lead, and total copper were somewhat higher in runoff from residential and commercial areas. The concentration of phosphorus and nitrogen were about an order of magnitude greater in discharges from POTWs.

[19] This is consistent with the finding of *Deposition of Air Pollutants to the Great Waters, 1994 Report to Congress*, EPA, 1994, which indicates that the environment may act as an important reservoir or source of persistent contaminants that have been released previously.

[20] EPA estimates that 76 million people, or 42 percent of the population served by sanitary sewage treatment works, are served by systems that either provide greater than secondary treatment or have no discharge. *1992 Needs Survey Report to Congress*, EPA, 1993.

Table 3-18. Comparison of Mean Pollutant Concentrations in Runoff From Residential and Commercial Areas to Sewage Treatment Plant Receiving Secondary Treatment

Constituent	Runoff from Residential and Commercial Sites (NURP)	Sewage Plant With Secondary Treatment
TSS (mg/l)	239	20
BOD (mg/l)	12	20
COD (mg/l)	94	33
Total P (mg/l)	0.5	6
Soluble P (mg/l)	0.15	5
TKN (mg/l)	2.3	20
Nitrate plus nitrite (mg/l)	0.86	NA
Total Cu (mg/l)	0.05	0.05
Total Pb (mg/l)	0.24	0.03
Total Zn (mg/l)	0.35	0.14

Source: POTW discharge concentrations for lead, zinc, copper, BOD, COD, TSS, and oil and grease were based on data reported in *Fate of Priority Pollutants in Publicly Owned Treatment Works* (EPA, 1981). This report summarizes monitoring data from POTWs receiving secondary treatment in 50 cities. Pollutant concentrations for total phosphorus, soluble phosphorus, and total Kjeldahl nitrogen were based on personal communication with Dolloff Bishop or the EPA Wastewater Engineering Laboratory in Cincinnati, Ohio. Recently, concerns have been raised regarding the validity and use of historical data for metals. As discussed in Chapter 2, EPA believes that historical data on storm water runoff from NURP and USGS are suitable for the purposes of this report.

3.3.1.2 Comparison of Pollutant Concentrations in Runoff from Residential/Commercial Areas to Water Quality Criteria

NURP determined that toxic metals were the most prevalent priority pollutants in runoff from commercial and residential areas. All 14 inorganic priority pollutants (13 metals, plus cyanides, excluding asbestos) were detected in urban storm water. As shown in Table 3-19, a number of these constituents were detected at levels exceeding EPA water quality criteria. The table also identifies organic pollutants found that exceeded certain EPA water quality criteria. These exceedances were observed less frequently than exceedances for the inorganic constituents. Levels of coliform bacteria were also found to exceed EPA water quality criteria during and immediately after storm events in many surface waters (EPA, 1983).

Table 3-19. Summary of Water Quality Criteria Exceedances for Pollutants Detected in at Least 10 Percent of NURP Samples—Percentage of Samples in Which Pollutant Concentrations Exceed Criteria[1]

Pollutant	Frequency of Detection(*)	Detection Samples[2]	Criteria Exceedances						
			None	FA	FC	OL	HH	HC[4]	DW
I. Pesticides									
α-Hexachlorocyclohexane	20	21/106						8,18,20	
γ-Hexachlorocyclohexane (Lindane)	15	15/100			8			0,10,15	
Chlordane	17	7/42		2	17			17,17,17	
α-Endosulfan	19	9/49			10				
II. Metals and Inorganics[5]									
Antimony	13	14/106	X					52,52,52	1
Arsenic	52	45/87						12,12,12	
Beryllium	12	11/94			6*				1
Cadmium[6]	48	44/91		8	48		1		1
Chromium[6,7]	58	47/81			1*				
Copper[6]	91	79/87		47	82				
Cyanides	23	16/71		3	22		4		
Lead[6]	94	75/80		23	94		73		73
Nickel[6]	43	39/91			5		21		
Selenium	11	10/88			5		10		10
Zinc[6]	94	88/94		14	77				
IV. Halogenated Aliphatics									
Methane, dichloro-	11	3/28						0,0,11	
VII. Phenols and Cresols									
Phenol	14	13/91	X						
Phenol, pentachloro	19	21/111		1*	11*	1			
Phenol, 4-nitro-	10	11/107	X						
VIII. Phthalate Esters									
Phthalate, bis(2-ethylhexyl)	22	15/69			22*				
IX. Polycyclic Aromatic Hydrocarbons									
Chrysene	10	11/109						10,10,10	
Fluoranthene	16	17/109	X						
Phenanthrene	12	13/110						12,12,12	
Pyrene	15	16/110						15,15,15	

*Indicates FTA or FTC value substituted where FA or FC criterion not available (see below).

[1] Based on 121 sample results received as of September 30, 1983, adjusted for quality control review. Where a value is reported for criteria exceedances, this value is a percentage of the number of samples where the pollutant was detected and blanks indicate no exceedances by any of the samples for which the pollutant was detected.

[2] Number of times detected/number of acceptable samples.

[3] FA = Freshwater ambient 24-hour instantaneous maximum criterion ("acute" criterion).
FC = Freshwater ambient 24-hour average criterion ("chronic" criterion).
FTA = Lowest reported freshwater acute toxic concentration. (Used only when FA is not available.)
FTC = Lowest reported freshwater chronic toxic concentration. (Used only when FC is not available.)
OL = Taste and odor (organoleptic) criterion.
HH = Non-carcinogenic human health criterion for ingestion of contaminated water and organisms.
HC = Protection of human health from carcinogenic effects for ingestion of contaminated water and organisms.
DW = Primary drinking water criterion.

[4] Entries in this column indicate exceedances of the human carcinogen value at the 10^{-5}, 10^{-6}, and 10^{-7} risk level, respectively. The numbers are cumulative (i.e., all 10^{-5} exceedances are included in 10^{-6} exceedances, and all 10^{-6} exceedances are included in 10^{-7} exceedances).

[5] Concerns have been raised regarding the validity and use of historical data for metals. As discussed in Chapter 2, EPA believes that historical data on storm water runoff from NURP and USGS are suitable for the purposes of this report.

[6] Where hardness dependent, hardness of 100 mg/l $CaCO_3$ equivalent assumed.

[7] Different criteria are written for the trivalent and hexavalent forms of chromium. For purposes of this analysis, all chromium is assumed to be in the less toxic trivalent form.

3.3.2 Pollutant Concentrations from Other Urban Land Uses

The NURP data base is limited to runoff from residential, commercial and industrial park land uses. These land uses typically comprise between 55 to 85 percent of the area of urban areas (EPA, 1990). Other major urban land uses which have the potential to contribute runoff with higher levels of pollutants include central business districts, industrial areas (typically 10 to 20 percent of the area of urban areas), and construction activities.

3.3.2.1 Central Business Districts

NURP noted that data describing runoff from central business districts are limited. However, NURP suggested that some central business districts may produce pollutant concentrations in runoff that are significantly higher than those from other sites in a given urban area. Pollutant loads from central business districts are thought to be significant because of the high pollutant concentrations coupled with the high degrees of imperviousness.

3.3.2.2 Industrial Land Uses

No truly industrial sites were included in any of the NURP projects. However, NURP suggested that runoff from industrial sites may have significantly higher contaminant levels than runoff from other urban land use sites. Several studies tend to support this suggestions, such as the Fresno, CA, NURP project which showed that industrial areas had the poorest storm water runoff quality of the four land-uses evaluated. Of the 62 non-pesticide constituents monitored, 52 were statistically highest in industrial site runoff. A study conducted in Spokane, WA, showed that industrial and commercial sites clearly contributed greater quantities of total dissolved solids, COD, total Kjeldahl nitrogen, lead and zinc (Oregon, 1986—Spokane Water Quality Management Program).

Given the range of different industrial activities in different urban areas, it would be difficult to characterize industrial runoff on a national basis. However, recent data collection efforts describing runoff from different types of industrial activities can be used to evaluate

the potential for pollutants in runoff from specific industrial areas. Chapter 4 summarizes some of these efforts.

3.3.2.3 Construction Activities

The amount of sediment in storm water discharges from construction sites can vary considerably, depending on whether effective management practices are implemented at the construction site. Uncontrolled or inadequately controlled construction site sediment loads have been reported to be on the order of 35 to 45 tons/acre/year (Novotny and Chesters, 1981). Sediment runoff rates from construction sites are typically 10 to 20 times that of agricultural lands, with runoff rates as high as 100 times that of agricultural lands; the rates are typically 1,000 to 2,000 times those of forest lands. Over a short period of time, construction sites can contribute more sediment to streams than was previously deposited over several decades.[21]

3.3.3 Pollutant Loading Estimates

EPA has developed loading estimates for selected pollutants in discharges from municipal separate storm sewer systems associated with urbanized areas.[22] Chapter 2 describes the methods used for estimating pollutant loads.

Table 3-20 summarizes pollutant load estimates for different classes of municipalities currently addressed by Phase I of the NPDES storm water program and potentially addressed under Phase II. EPA estimates that in 1990, about 40 percent of the pollutant loads associated with runoff from urbanized areas came from Phase I municipalities. About one-quarter of the pollutant loads in runoff from urbanized areas came from potential Phase II

[21] Under current regulations, construction activities resulting in the disturbance of 5 or more acres are covered by the NPDES storm water program.

[22] The model used to estimate pollutant loads assumed constant concentrations for each of the seven pollutants. This assumption results in the ratio of loadings of different pollutants remaining constant for different classes of municipalities. Thus, where the percentage of pollutant loadings is presented, the percentage is the same for all seven pollutants.

Table 3-20. Estimated Pollutant Loadings in Runoff From Urbanized Areas

Classification	Population Category	Number of Urbanized Areas*	Population* (millions)	Total Area** (sq. mi.)	Number of Incorporated Places*	Number of Minor Civil Divisions*	Number of Counties*	Percentage of Urbanized Area Loading
NATIONAL		405	252.2	3,540,166	19,289	17,796	3,141	NA
ALL URBANIZED AREAS	50,000 - 99,999	176	12.2	7,674.0	457	285	251	12
	100,000 -249,999	125	19.5	10,243.0	485	350	154	16
	Over 250,000	104	128.7	43,603.0	2,649	939	296	72
	TOTAL	405	160.4	61,520.0	3,591	1,574	703	100
URBANIZED AREAS AFFILIATED WITH PHASE I MS4s								
– Phase I MS4s within Phase I affiliated Urbanized Areas	50,000 - 99,999	8	0.4	210.7	9	0	6	0
	100,000 - 249,999	47	6.3	3,066.4	51	0	13	5
	Over 250,000	81	75.0	21,741.9	504	0	53	35
	SUBTOTAL	136	81.7	25,019.0	564	0	72	40
– Phase II Portions of Phase I affiliated Urbanized Areas	50,000 - 99,999	8	0.2	102.5	10	1	4	1
	100,000 - 249,999	47	1.9	1,174.4	69	58	62	2
	Over 250,000	81	33.7	14,944.8	1,508	575	239	25
	SUBTOTAL	136	35.8	16,221.7	1,587	634	305	28
	TOTAL	136	117.5	41,240.7	2,151	634	377	68
URBANIZED AREAS NOT AFFILIATED WITH A PHASE I MS4								
– Urbanized Areas Not Affiliated with Phase I MS4s	50,000 - 99,999	168	11.6	7,232.7	443	284	242	11
	100,000 -249,999	78	11.3	5,823.0	371	297	91	9
	Over 250,000	23	20.0	6,176.7	656	385	47	12
	TOTAL	269	42.9	19,606.0	1,470	966	380	32
– Urbanized Areas Containing a City with a CSO Exemption**	50,000 - 99,999	0	0	0	0	0	0	0
	100,000 -249,999	7	1.5	661.2	40	70	17	1
	Over 250,000	14	16.0	5,242.5	524	358	43	9
	TOTAL	21	17.5	5,903.7	564	428	60	10
PHASE I MS4s OUTSIDE URBANIZED AREAS		NA	4.3	86,097	57	0	5	NA

* Totals are based upon 1990 Census, and include Puerto Rico, Guam, Virgin Islands, American Samoa, and the Commonwealth of the Northern Mariana Islands.
** Some municipalities identified in the November 1990 application regulations (55 *FR* 47990) as Phase I based on 1980 census data received combined sewer exclusions from Phase I where the total population served by separate storm sewers was less than 100,000 after subtracting the population served by combined sewers. (The 21 urbanized areas [with a population of 17.5 million] containing these municipalities are also contained in the above totals and are not in addition to those totals.)

portions of urbanized areas with a Phase I municipality. An additional one-third of the pollutant loadings associated with urbanized areas came from urbanized areas that do not have a Phase I municipality.

Table 3-21 compares annual pollutant loadings for three metals, zinc, lead, and copper, from urban runoff from the Metropolitan Washington urbanized area, with a sewage treatment plant that provides advanced treatment and that serves about 2 million people (the Blue Plains sewage treatment plant), and major industrial process wastewater discharges located in Maryland and Virginia. In general, the data in Table 3-21 indicates that the annual loadings of metals, nutrients, and oxygen demanding pollutants in urban runoff from the Washington, DC, area are higher than the loadings from the predominant sewage treatment plant for the area (the Blue Plains Sewage Treatment Plant provides advanced treatment and serves approximately two million people). The data also indicate that the annual loadings of zinc and lead in urban runoff from the Washington, DC, area are higher than the loadings from all industrial point source discharges from facilities in Maryland and Virginia that reported pollutant release information in 1987 to the Toxic Release Inventory established under the Emergency Planning and Community Right-to-Know Act.

Table 3-21. Annual Pollutant Loadings in Pounds for Selected Pollutant Sources

Pollutant	Urban Storm Water from Metropolitan Washington	Blue Plains Sewage Treatment Plant[1]	All MD and VA Direct Industrial Discharges in 1987 Toxic Release Inventory
Zinc	480,000	137,000	132,000
Lead	132,600	5,500	31,300
Copper	113,000	21,000	127,000
Nitrogen	30,000,000	12,000,000	not available
Phosphorus	1,200,000	113,000	not available
BOD5	9,500,000	1,400,000	not available

[1] Portions of collection system for Blue Plains are combined sewers carrying both runoff and sewage. The POTW loadings do not account for discharges from combined sewer overflows. The loadings estimate does account for urban storm water that is conveyed to Blue Plains, treated, and discharged. Recently, concerns have been raised regarding the validity and use of historical data for metals. As discussed in Chapter 2, EPA believes that historical data on storm water runoff are suitable for the purposes of this report.

A number of factors are expected to result in future changes to total loadings and the distribution of loadings between Phase I and Phase II municipalities. Factors that would generally increase loadings include increases in population and the area of urbanized areas. If recent development trends continue, most increases in loadings are expected to occur in urbanized areas with a Phase I municipality. The majority of the increase in loadings in these areas is expected to occur in suburban areas surrounding core cities.

The increased implementation of storm water management measures is expected to generally decrease pollutant loadings. Given the existing Federal mandate for storm water controls, such decreases are expected to occur in Phase I municipalities sooner than in potential Phase II municipalities.

Widespread product substitutions associated with activities that generate pollutants ultimately discharged in storm water may either increase or decrease pollutant loads, depending on the nature of such substitutions.

When analyzing annual loadings associated with urban runoff, it is important to recognize that discharges of urban runoff are highly intermittent and that the short-term loadings associated with individual events will be high and may have shockloading effects on receiving water.

3.3.4 Floatables/Litter/Plastics

Litter is common in urbanized areas. During storm events, litter can be washed into separate storm sewers or carried through other storm water conveyances to receiving waters. Litter is also commonly disposed of directly to storm sewer catchbasins. Discharges from separate storm sewers were identified as major sources of plastics to the surface waters in *Methods to Manage and Control Plastics Wastes—Report to Congress*, (EPA, 1989). Another study concluded that the majority of floating litter that washes up on New Jersey's beaches originates from discharges from separate storm sewers (New Jersey DEP, 1988).

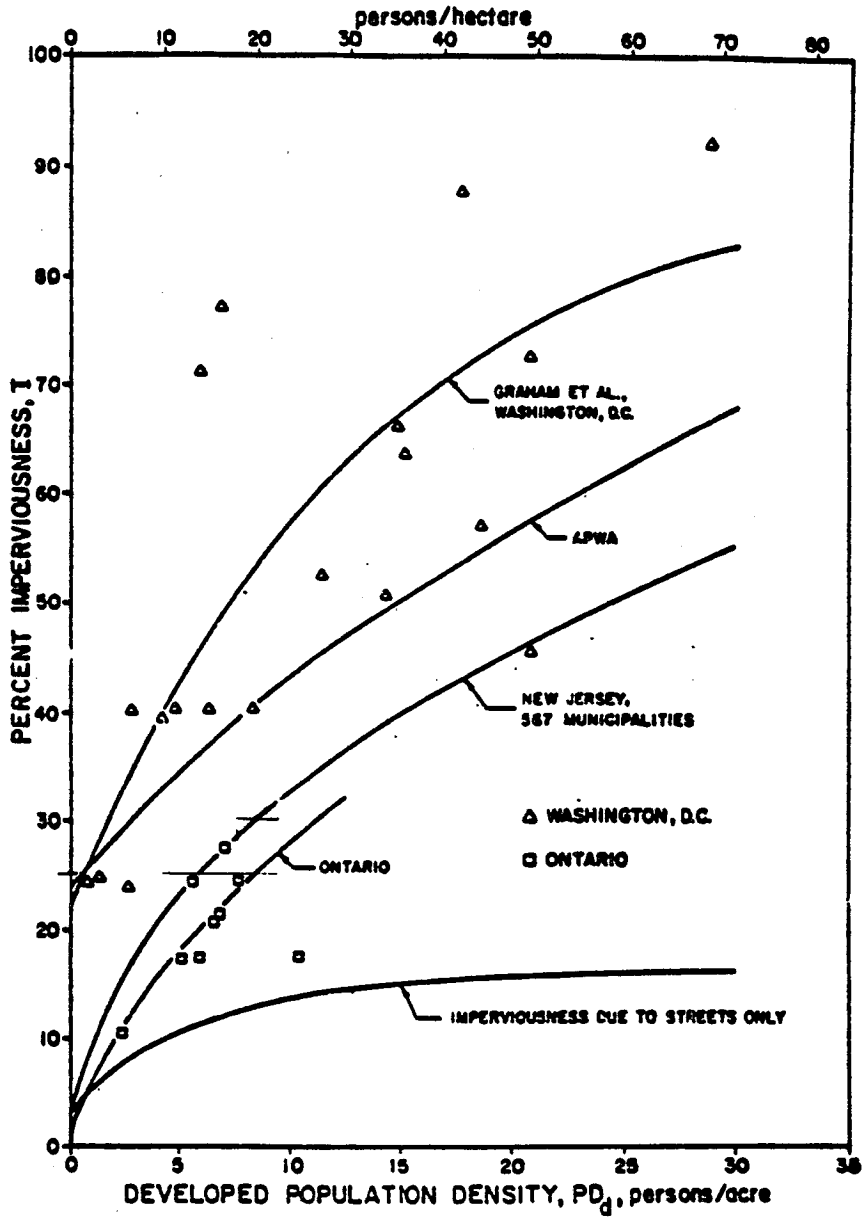
Litter can cause significant aesthetics problems and impact the operating effectiveness of drainage systems and related management practices such as detention ponds.

3.3.5 Population Densities and Imperviousness

As discussed previously, the amount of imperviousness in urban watersheds can be linked to impacts to streams and other surface water resources. The population density of a municipality can be used as an indicator of the level of imperviousness. Figure 3-7 summarizes several studies that attempted to link population densities to percent imperviousness (Kobriger, 1984). However, using population density as an indicator of imperviousness does not account for high levels of day-time use associated with many commercial or industrial areas with high levels of imperviousness.

Population density is related to the total urban population in an area. Table 3-1, presented previously, indicates that as the total population of an urbanized area increases, so does the average population density. The average population density of urbanized areas with a total population of 1,000,000 or more (3,413 persons per square mile) is more than double the average population density of urbanized areas with a population of 50,000 to 100,000 (about 1,600 persons per square mile).

The population density varies within urbanized areas. Core cities generally have a higher population density than outlying suburban areas. However, other smaller cities that are part of larger urbanized areas can have high population densities. In 1990, the Bureau of the Census reported more than 600 incorporated places with populations under 100,000 but with a population density of at least 5,000 persons per square mile. Approximately 550 of the more than 600 incorporated places meeting this criterion were in an urbanized area. Approximately 415 of these incorporated places are in an urbanized area where at least one Phase I municipality is located.



Source: Kobriger, 1984.

Figure 3-7. Relationship Between Population Density and Percent Imperviousness

3.4 SUMMARY

Bureau of the Census estimates that the population of the United States and associated territories was more than 252.2 million in 1990[23] and that there are 19,289 incorporated places and 17,796 minor civil divisions in the continental United States, Alaska and Hawaii. These incorporated places and minor civil divisions are located in 3,141 counties or county equivalents.

The concept of Bureau of the Census-designated urbanized areas served as an important tool for analyzing potential approaches to a Phase II program that addresses municipal separate storm sewer systems. More than 160 million people (63 percent of the total United States population) reside in the 405 urbanized areas with a population of 50,000 or more that have been designated by the Bureau of the Census. These areas occupy less than 2 percent of the Nation's total land area. These areas represent the largest, most widespread areas of dense urban development in the country.

The majority of new urban development also occurs in Census-designated urbanized areas. Construction activity related to new development is recognized as a significant source of pollution and impairment of waterbodies, providing some of the best opportunities for implementing storm water management controls in a highly cost-effective fashion. Between 1980 and 1990, the population of Census-designated urbanized areas increased by 21.2 million.[24] During the same time period, the rural population of the United States increased by 2.2 million, and the urban population that lived outside of urbanized areas increased by 0.9 million. Between 1980 and 1990, the population of urbanized areas with one or more municipal systems addressed by Phase I of the NPDES storm water program increased by 16.4 million (or 75 percent of the total National growth). This represents a 25 percent

[23] Population estimates based on the 50 States, the District of Columbia, Guam, the Commonwealth of Puerto Rico, the Virgin Islands, American Samoa, and the Commonwealth of the Northern Mariana Islands.

[24] About 7 percent of this increase, (1.5 million people) are associated with the net addition of 30 new urbanized areas between 1980 and 1990. Another part of this increase which has not been estimated here is associated with the increase in land area of pre-existing urbanized areas.

increase in the population of these areas. The population of urbanized areas without a Phase I municipal system increased by 2.6 million. This represents 12 percent of the total national growth and a 7 percent increase in the population of these areas.

The population and number of municipalities in urbanized areas, and estimated percentage of pollutant loads in runoff from urbanized areas are summarized in Table 3-20 and discussed below.

Phase I of the NPDES program for storm water discharges addresses 621 incorporated places (cities) and portions of 77 counties.[25] These municipalities had a combined population of 86 million people in 1990. Cities with a population of 100,000 or more whose municipal systems are already addressed by Phase I of the NPDES storm water program increased in population by about 4.9 million between 1980 and 1990.[26] The majority of the population of Phase I municipalities, 81.7 million people live in 136 of the 405 Census-designated urbanized ares. EPA estimates that about 40 percent of the pollutant loads in storm water discharged from urbanized areas come from Phase I municipalities.

The Phase II portions of the 136 urbanized areas with one or more Phase I municipal separate storm sewer system had a combined population of 35.8 million people. The population of those portions of these urbanized areas increased by 2.6 million between 1980 and 1990. EPA estimates that 1,587 incorporated places, 634 minor civil divisions, and parts of 305 counties are located in the Phase II portions of these urbanized areas. EPA estimates that 28 percent of the pollutant loads in storm water discharged from urbanized areas come from Phase II portions of the 136 urbanized areas with a Phase I municipality.

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[25] Of these municipalities, 140 cities and 45 counties are specifically identified in the NPDES regulations that were published in November of 1990. EPA and authorized NPDES States have designated an additional 481 cities and 32 counties as Phase I municipalities. In addition, approximately 30 municipalities (located in 21 urbanized areas) have received combined sewer exclusions where the total population served by separate storm sewers is less than 100,000 after subtracting the population served by combined sewers. The methodology used to classify municipalities as Phase I vs. Phase II for the purposes of this report is explained in Chapter 2.

[26] The 4.9 million increase does not include increases associated with unincorporated, urbanized portions of Phase I counties and designated municipalities.

A total of 269 of the Census-designated urbanized areas do not have a municipality with separate storm sewers subject to Phase I of the storm water program. The 269 urbanized areas without a Phase I municipal separate storm system have a combined population of 42.9 million people. EPA estimates that 1,470 incorporated places, 966 minor civil divisions, and parts of 380 counties are located in these urbanized areas. EPA estimates that about one-third of the pollutant loads in storm water discharged from urbanized areas come from the 269 urbanized areas without a Phase I municipality. Of the 269 urbanized areas without a Phase I municipal system, 101, or over a third, have a population of more than 100,000, and 23 have a population of more than 250,000.

In addition to populations within urbanized areas discussed above, the Bureau of the Census has identified an additional urban population of 29 million people that live outside of urbanized areas, as well as 62.8 million people classified as rural. Of this total, 25.1 million people live in 3,689 incorporated places. The remaining 4 million people live in either minor civil divisions or unincorporated portion of counties. Although discharges from municipal separate storm sewer systems serving these populations are potential Phase II sources, they are not addressed in this report.

CHAPTER 4. INDIVIDUAL PHASE II DISCHARGES

This chapter identifies the discharges of storm water other than those from municipal separate storm sewer systems for which permits are not currently required and assesses, to the extent practicable, the nature and extent of pollutants in those discharges. To provide a context for this analysis, this chapter begins with an overview of the industrial categories that are addressed under Phase I of the storm water regulatory program. Using an approach described in Chapter 2 of this report, other categories of industrial, commercial, and retail facilities that may be sources of polluted storm water discharges are identified. For these potential Phase II sources, the type of their discharges and statistics on their geographic distribution are described. The nature of industrial storm water discharges is characterized using a summary of the sampling data reported by Phase I group permit applicants and comparing groups of Phase II sources to these Phase I industries. In an analysis patterned after that in Chapter 3, this chapter also explores the relationship between individual Phase II industrial, commercial, and retail facilities and urbanized areas of different configurations. The final section of this chapter summarizes the results of the analyses and offers some perspectives on individual Phase II storm water discharges. The results of these analyses are meant to be guideposts and are not intended to be an identification of specific industrial categories that must be regulated under Phase II.

4.1 OVERVIEW OF INDIVIDUAL PHASE II SOURCES

There are more than 7.7 million industrial, commercial, retail, and government facilities in the United States.[1] The Office of Management and Budget classifies businesses into categories based on similarity of economic activity. Some aspects of this discussion are

[1] This estimate is based on data from the FACTS data base, which is leased by EPA from Dun & Bradstreet Information Services, which created, maintains, and annually updates information based on a variety of sources. This estimate does not include inactive and abandoned mines which may constitute hundreds of thousands of additional sources.

based on this Standard Industrial Classification (SIC) code system.[2] Table 4-1 presents a breakdown of the major categories of industry and commerce. The current storm water regulatory program potentially applies to some types of individual facilities within the mining, construction, manufacturing, and transportation divisions. There are more than 850,000 enterprises in these divisions; however, only a portion of these are within the 11 categories of activities "associated with industrial activity" as defined by the November 1990 storm water permit application regulations.[3] As a result, from these 850,000 enterprises, EPA has estimated that approximately 150,000 facilities are currently subject to Phase I requirements.

Table 4-1. Summary of Major SIC Divisions of U.S. Commerce

Description	Total Facilities	SIC Codes Covered
Agriculture, Forestry, and Fishing	310,086	01 - 09
Mining	39,936	10 - 14
Construction	805,100	15 - 17
Manufacturing	511,831	20 - 39
Transportation and Public Utilities	306,894	40 - 49
Wholesale Trade	582,681	50 - 51
Retail Trade	1,850,121	52 - 59
Finance, Insurance, and Real Estate	672,693	60 - 67
Services	2,585,750	70 - 89
Public Administration	71,379	90 - 97
Total	7,736,471	

The remaining universe of facilities fall into two main groups, those that have a statutory or regulatory exemption, including agricultural and most silvicultural activities, and those that are considered to be potential Phase II activities. Many of these potential Phase II

[2] The Standard Industrial Classification (SIC) code system organizes industries into categories and subcategories. Major groups are designated by a two-digit code number between 01 and 99. Within major groups, facilities are further categorized at the industry group (3-digit) level and industry (4-digit) level.

[3] This figure excludes about 800,000 building, construction, and specialty contractors, which are regulated to the extent that they engage in construction activities disturbing 5 acres or more.

sources, however, are not expected to become subject to Phase II regulation. Sources that are not in Phase I and are not expected to become subject to NPDES storm water regulation in Phase II consist of sources that lack the potential to contribute significant levels of pollutants to storm water, including financial institutions, some governmental activities and many types of service organizations.

The remaining categories of light industrial, commercial, retail, governmental establishments, and residential activities represent the universe of facilities under consideration for potential inclusion in Phase II. These facilities fall into several general categories with respect to Phase II:

- Facilities with activities essentially identical or closely related to those "associated with industrial activity," that are not covered for a variety of statutory and regulatory reasons.
- Facilities with activities similar to those "associated with industrial activity," such as transportation activities, energy producers and distributors, and utilities.
- Commercial activities with industrial components, such as assembly and repair operations.
- Agriculture-related operations that include currently unregulated feedlots.[4]
- Non-agricultural operations with potential for use of pesticides and fertilizers.
- Facilities and households with failing septic systems.
- Other facilities with potential to use or produce toxic substances, including laboratories and some governmental facilities.

In general, the geographic distribution of industrial, commercial, and retail activity—in short, economic activity—tends to be closely associated with population and population

[4] To be subject to the NPDES program, sources must have point source discharges of pollutants to waters of the United States. EPA has defined concentrated animal feeding operations (CAFOs) as point sources currently subject to permitting under NPDES. This study looks at feedlots which do not meet the regulatory definition of CAFO to study their impacts on water quality and to identify them as potential sources to be covered under Phase II.

density. Through this relationship between population and economic activity, this industrial analysis can be compared with the municipal analysis undertaken in the previous chapter. The Phase I municipal approach is taken as the starting point for a locational analysis of industrial Phase I and potential Phase II sources in this chapter. The municipal component of Phase I of the storm water regulatory program focuses on the largest cities and counties, which contain about one-third of all the facilities in both regulated and nonregulated categories. There are a few notable exceptions to this relationship between economic activity and population, including agricultural and mining activity. These are discussed in more detail later in this chapter.

4.1.1 The Phase I Permitting Framework for Industrial Discharges

Section 402(p) of the CWA provides that EPA or NPDES-approved States cannot require a permit for storm water discharges from individual sources before October 1, 1994, except for discharges "associated with industrial activity" or those that had a permit prior to February 4, 1987, unless they are significant contributors of pollutants to waters of the United States or contribute to the violation of a water quality standard. The Act also clarifies that permits for discharges associated with industrial activity must meet all of the applicable provisions of CWA Sections 402 and 301, including both applicable technology-based requirements and water quality-based standards. All other storm water discharges that are potential candidates for coverage fall under Phase II of the program. The basic permitting framework for Phase I of the NPDES storm water program is established in 40 *CFR* 122, primarily Section 122.26.

The November 16, 1990, storm water regulations described 11 categories of industrial facilities that defined the term "discharges associated with industrial activity." The categories were derived from a combination of narrative descriptions and specific SIC code designations to define and identify Phase I sources (40 *CFR* 122.26(b)(14)). The types of industrial facilities covered by the definition are illustrated in Table 4-2.

Table 4-2. Industrial Facilities That Must Submit Applications for Storm Water Permits (Phase I)

40 *CFR* 122.26(b)(14) Subpart	Description
(i)	Facilities subject to storm water effluent limitations guidelines, new source performance standards, or toxic pollutants effluent standards under 40 *CFR*, Subchapter N [except facilities which are exempt under category (xi)].
(ii)	Facilities classified as: SIC 24 (except 2434) . . . . . Lumber and Wood Products SIC 26 (except 265 and 267) . Paper and Allied Products SIC 28 (except 283 and 285) . Chemicals and Allied Products SIC 29 . . . . . Petroleum and Coal Products SIC 311 . . . . . Leather Tanning and Finishing SIC 32 (except 323) . . . . . Stone, Clay and Glass Products SIC 33 . . . . . Primary Metal Industries SIC 3441 . . . . . Fabricated Structural Metal SIC 373 . . . . . Ship and Boat Building and Repairing
(iii)	Facilities classified as SIC 10 through 14, including active or inactive mining operations and oil and gas exploration, production, processing, or treatment operations, or transmission facilities that discharge storm water contaminated by contact with, or that has come into contact with, any overburden, raw material, intermediate products, finished products, byproducts, or waste products located on the site of such operations. SIC 10 . . . . . Metal Mining SIC 11 . . . . . Anthracite Mining SIC 12 . . . . . Coal Mining SIC 13 . . . . . Oil and Gas Extraction SIC 14 . . . . . Nonmetallic Minerals, except Fuels
(iv)	Hazardous waste treatment, storage, or disposal facilities, including those that are operating under interim status or a permit under Subtitle C of the Resource Conservation and Recovery Act (RCRA).
(v)	Landfills, land application sites, and open dumps that receive or have received any industrial wastes including those that are subject to regulation under subtitle D or RCRA.
(vi)	Facilities involved in the recycling of material, including metal scrapyards, battery reclaimers, salvage yards, and automobile junkyards, including but not limited to those classified as: SIC 5015 . . . . . Motor Vehicle Parts, Used SIC 5093 . . . . . Scrap and Waste Materials
(vii)	Steam electric power generating facilities, including coal handling sites.
(viii)	Transportation facilities which have vehicle maintenance shops, equipment cleaning operations, or airport de-icing operations. Only those portions of the facility that are either involved in vehicle maintenance (including vehicle rehabilitation, mechanical repairs, painting, fueling, and lubrication), equipment cleaning operations, or airport de-icing operations, or which are otherwise listed in another category, are included. SIC 40 . . . . . Railroad Transportation SIC 41 . . . . . Local and Suburban Transit SIC 42 (except 4221-25) . . . . Motor Freight and Warehousing SIC 43 . . . . . U.S. Postal Service SIC 44 . . . . . Water Transportation SIC 45 . . . . . Transportation by Air SIC 5171 . . . . . Petroleum Bulk Stations and Terminals

Table 4-2. Industrial Facilities That Must Submit Applications for Storm Water Permits (Phase I) (continued)

40 *CFR* 122.26(b)(14) Subpart	Description
(ix)	Treatment works treating domestic sewage or any other sewage sludge or wastewater treatment device or system, used in the storage, treatment, recycling, and reclamation of municipal or domestic sewage, including lands dedicated to the disposal of the sewage sludge that are located within the confines of the facility, with a design flow of 1.0 million gallons per day or more, or required to have an approved pretreatment program under 40 *CFR* Part 403. Not included are farm lands, domestic gardens, or lands used for sludge management where sludge is beneficially reused and which are not physically located in the confines of the facility, or areas that are in compliance with Section 405 of the CWA.
(x)	Construction activity including clearing, grading, and excavation activities except operations that result in the disturbance of less than 5 acres of total land area and those that are not part of a larger common plan of development or sale.
(xi)	Facilities under the following SICs [which are not otherwise included in categories (ii)-(x)], including only storm water discharges where material handling equipment or activities, raw materials, intermediate products, final products, waste materials, byproducts, or industrial machinery are exposed to storm water. SIC 20 . . . . . Food and Kindred Products SIC 21 . . . . . Tobacco Products SIC 22 . . . . . Textile Mill Products SIC 23 . . . . . Apparel and Other Textile Products SIC 2434 . . . . . Wood Kitchen Cabinets SIC 25 . . . . . Furniture and Fixtures SIC 265 . . . . . Paperboard Containers and Boxes SIC 267 . . . . . Converted Paper and Paper Board Products (except containers and boxes) SIC 27 . . . . . Printing and Publishing SIC 283 . . . . . Drugs SIC 285 . . . . . Paints, Varnishes, Lacquer, Enamels SIC 30 . . . . . Rubber and Misc. Plastics Products SIC 31 (except 311) . . . . . Leather and Leather Products SIC 323 . . . . . Products of Purchased Glass SIC 34 (except 3441) . . . . . Fabricated Metal Products SIC 35 . . . . . Industrial Machinery and Equipment, except Electrical SIC 36 . . . . . Electronic and Other Electric Equipment SIC 37 (except 373) . . . . . Transportation Equipment SIC 38 . . . . . Instruments and Related Products SIC 39 . . . . . Miscellaneous Manufacturing Industries SIC 4221 . . . . . Farm Products Warehousing and Storage SIC 4222 . . . . . Refrigerated Warehousing and Storage SIC 4225 . . . . . General Warehousing and Storage

Source: *Federal Register*, Vol. 55, No. 222, p. 48065, November 16, 1990.

Note: On June 4, 1992, the U.S. Court of Appeals for the Ninth Circuit remanded the exemption for construction sites of less than five acres and for manufacturing facilities in category (xi) which do not have materials or activities exposed to storm water to the EPA for further rulemaking. *NRDC* v. *EPA*, 966 F.2d 1292 (9th Cir. 1992). In response to the remands, the Agency intends to conduct further rulemakings on both the light manufacturing and the construction activities. In the December 18, 1992, *Federal Register*, EPA stated that it is not requiring permit applications from construction activity under five acres or light industry without exposure until this further rulemaking is completed.

For a more complete discussion of the interpretation of this definition, refer to the *NPDES Storm Water Program Question and Answer Document*, Parts I and II (EPA, 1992, 1993), which appear in Appendix D.

The original permitting framework of Phase I provided operators of industrial facilities with three options for applying for NPDES permit coverage. They could (1) submit individual applications, (2) participate in a group application, or (3) submit a notice of intent to be covered by a general permit.[5] For the first phase of the storm water program, EPA issued general permits to facilitate permitting the large number of facilities covered by the program on September 9, 1992 (57 *FR* 41176), September 25, 1992 (57 *FR* 44412), and April 14, 1993 (58 *FR* 19427). This Phase I framework is the result of a lengthy rulemaking process that included opportunities for, and response to, public comment. In addition, authorized NPDES States have issued numerous other general permits for facilities within their States.

Section 402(p)(2)(E) of the CWA allows EPA or States to require permits for any other discharges determined to be a contributor to a violation of a water quality standard or a significant contributor of pollutants to waters of the United States. Thus, the Phase I approach provides the foundation for extending regulation to additional sources and classes of discharges, as appropriate.

4.1.2 Industrial, Commercial, and Retail Sources *Not* Subject to Phase I Permit Requirements

This section responds to Congress' first mandate in CWA Section 402(p)(5): to identify the sources of storm water discharges for which permits are not currently required under Phase I. This chapter addresses individual Phase II sources; municipal separate storm sewer systems were discussed in Chapter 3. Based on a review of those facilities not subject to Phase I permitting requirements and a screening procedure based on information drawn from the literature review, activities were identified that may present opportunities for pollutant releases to storm water. The purpose of the source identification is to present the

[5] The group application permitting option is no longer available to permit applicants because the application deadlines have passed. EPA proposed an industry-specific multi-sector model general permit based on the information received through the group application process on November 19, 1993. EPA will be finalizing the multi-sector general permit in the near future.

full range of potential Phase II sources and to characterize them to the extent possible to facilitate decision making on the appropriate scope and approach of Phase II. The screening process was used to narrow consideration to a subset of facilities that may be appropriate for coverage under Phase II. Both the regulatory analysis and screening procedure are described below.

4.1.2.1 Phase I Regulatory Review

In defining "storm water discharges associated with industrial activity," the Phase I regulations identify 11 categories of facilities considered to be engaging in "industrial activity" (see Table 4-2). Only those facilities described in the 11 categories of the definition that have point source discharges of storm water are required to apply for storm water permit coverage under Phase I of the program. As shown in Table 4-2, regulated activities under Phase I were identified by SIC category, narrative descriptions of activities, or, in some cases, both. For example, Category viii regulated activities are defined as "only those portions of the facility that are either involved in vehicle maintenance . . ., equipment cleaning operations, or airport de-icing operations, or which are otherwise listed in another category . . . ." Seven separate SIC codes are then listed, including six two-digit codes and one four-digit code; several four-digit codes were specifically omitted from coverage.

There are a number of sources closely related to Phase I activities that are currently unregulated. One general class includes construction activities that disturb less than 5 acres (Category x) and light industrial activities that have no exposure of materials to storm water (Category xi). On June 4, 1992, the Court of Appeals for the Ninth Circuit remanded the exemption of both of these categories from the original storm water regulations.[6] The court found that EPA had not adequately established that light industrial facilities without exposure of materials or operations to storm water and construction sites disturbing less than 5 acres were non-industrial in nature.

[6] *Natural Resources Defense Council v. EPA,* 966 F.2d 1292 (9th Cir. 1992).

In response to the Ninth Circuit Court ruling, EPA issued a *Federal Register* notice on December 18, 1992, to explain the outcome of the ruling and to request comment and specific factual information to assist in the development of a new proposal to address light industry and small construction site categories. EPA noted that it did not believe that the court's decision has the effect of automatically subjecting small construction sites and light industries to the existing application requirements and deadlines. The Agency also indicated that it believed that additional notice and comment were necessary to clarify the status of these facilities. To the extent that some or all of these facilities may not be addressed by Phase I, they would be potential Phase II sources.

Additional categories of potential Phase II facilities have been identified based on the screening procedure described below.

4.1.2.2 Screening Procedure

Potential Phase II sources, categories, and activities were identified using previous information and additional screening based on the major sectors of the economy identified by SIC codes. Identifying potential Phase II sources based on SIC codes facilitates quantitative analysis of the numbers of facilities potentially subject to Phase II and provides a basis for a geographical location analysis that parallels the municipal analysis in Chapter 3. The geographical analysis (discussed in Section 4.2.2) was developed to show the distribution and "concentration" of non-domestic enterprises across the country and their association with various sizes and types of population centers. This geographical approach could later be related to a water quality or environmental assessment at a finer level of detail at the regional, state or local level.

As discussed in Chapter 2, major sectors of the economy are defined on the basis of the two-digit SIC code. This two-digit code is a relatively general categorization of the Nation's economic activity: all industrial, commercial, and retail activities are organized into 83 two-digit SIC codes. The four-digit SIC code provides a more detailed breakdown of these

enterprises and is much more specific to the activities conducted at the establishment. Although all unregulated activities are potential Phase II sources, in practical terms, only a subset of four-digit SIC industry groups has real potential to use, process, or store pollutant-bearing materials or to engage in activities that could lead to contamination of storm water.

SIC codes are assigned by economic activity, not pollution potential. However, economic activities often correspond to physical activities or use of specific materials that can be assessed relative to the potential to generate storm water pollution. Thus, SIC codes can serve as an indicator of the underlying activities or materials of concern, even if they cannot be used to directly assess environmental effects.

The screening process described below focuses on two broad classes of facilities. The first (designated Group A) consists of facilities that fall within the same general range of SIC codes as Phase I industrial activities but that are not covered under Phase I. The second major group (designated Group B) consists of a specific subset of four-digit SIC codes of concern (outside SIC codes 10-45) where discharges of pollutants are suspected based on case studies, expert opinion, literature review, other EPA programs and concerns, and experience with Phase I of the storm water program.

This screening process does not establish negative environmental effects from storm water discharges. It does serve as a tool for focusing attention on those categories potentially contributing to storm water pollution. The geographical analysis reported in Section 4.2.2 allows EPA to determine how these specific categories of potential Phase II facilities are distributed nationally in geographic areas of concern (e.g., urbanized areas).

The following criteria were used to identify four-digit SIC codes of primary environmental concern. First, facilities highly similar to Phase I facilities are identified (Group A). Next, an additional 12 categories of potential Phase II sources are identified based on their similarity to Phase I activities or based on case studies and expert opinion

(Group B). These 12 Group B categories are then related to specific SIC code groupings for subsequent analysis in Section 4.2. The categories identified through this process represent the types of establishments or activities that may warrant further investigation and control under Phase II. This preliminary identification does not establish that water quality impacts are occurring.

As noted earlier, the SIC code system is a useful framework for identifying the numbers and locations of facilities. The SIC approach allows EPA to access information from many sources with a very precise level of detail, because of the efforts of many organizations (e.g., Commerce Department) to record and track economic activity by industrial category. Still, focusing on SIC codes for the purposes of this study does not imply that a regulatory strategy must proceed on this basis. The types of activities conducted at these facilities could be regulated through narrative descriptions, as was done for some categories in Phase I. Experience with the Phase I definition of "discharges associated with industrial activity" suggests that SIC designations alone may not be completely satisfactory because activities of concern may be conducted at a wide variety of facilities that do not happen to have the same primary SIC code. In addition, other potential Phase II sources that are not reflected by the SIC code system, including parking lots, large retail complexes, and facilities or residences with septic systems for septic wastewater disposal, can similarly be studied for impacts on water quality or regulated based on narrative description. Even within an SIC-based regulatory framework, additional factors, such as size, location, pollutant usage, or activity cutoffs or restrictions, can be used to identify specific facilities for regulation based on a potential correlation between facilities and water quality impacts.

The SIC system does not capture some types of facilities or activities that generate storm water discharges. SIC codes are designated based on the primary activity in which an establishment is engaged. A business that is involved in a number of different activities will be classified according to a single industrial code, which may not reflect activities associated with storm water discharges. In addition, some facilities carry out activities off-site, such as

material storage and vehicle maintenance, that will not have independent business identities and, thus, no separate SIC designations. Similarly, the SIC system may not identify all facilities that are owned or operated from a remote central business location. The SIC system also does not individually identify industrial activities associated with municipalities. Although some municipal services (e.g., public ambulance services) are identified, other types of activities (e.g., municipal power generating facilities) are not captured within the SIC system. Even with these limitations, EPA analysis of potential Phase II sources in terms of SIC code assignments provides an extremely valuable analytical tool to assess the location and concentration of these activities at the national level.

Group A Sources

Although Phase I industrial activities generally fall within SIC codes 10-45, there are many omissions and exceptions within this range. While some of these omissions were intentional, others are the result of the specificity of the 1990 application regulations. Other facilities have been excluded from Phase I based on specific legislative changes. These classes of facilities are deserving of special attention due to their extreme similarity to Phase I industrial activities. For the purposes of discussion and analysis in this report, these facilities have been classified as Group A.

To clearly identify Phase II facilities that fall within the SIC range 10-45, a list of unregulated activities related to Phase I sources in each of the 11 industrial categories was developed. This list appears in Table 4-3. The similarity of many of the facilities on this list to Phase I facilities makes them difficult to distinguish from Phase I facilities for the purposes of the analyses in this report. In order to help characterize these sources, they have been categorized below according to three main criteria. The three groups identified together make up Group A. Although these groups do not encompass every one of the possible exceptions presented in Table 4-3, they represent the majority of facilities in SIC codes 10-45 that were not addressed under Phase I.

Table 4-3. Categories of Activities *Not* Regulated Under Phase I

Category	Activities and Facilities
i	• Facilities that were not considered for inclusion in the effluent guideline formulations
ii	• Offsite warehouses (unless auxiliary to a regulated facility) • Offsite salt storage piles • Chemical distributors that conduct incidental mixing and blending of products • Distributors of farm products and equipment with mixing and blending of fertilizers (not SIC 2875)
iii	• Pipelines • Petroleum product distribution, including SIC 49
iv	• Hazardous waste generation/storage sites subject to certain RCRA Subtitle C requirements but not permitting
v	• Landfills that have not received or do not receive industrial waste (Municipal Solid Waste Landfills (MSWLFs)) • Solid waste transfer stations with no vehicle maintenance or that are owned or operated by the entity that owns the final disposal site • Land application of sewage treatment plant effluent (exempted from RCRA requirements) • Incinerators (BIFs and municipal incinerators) (hazardous waste incinerators are permitted under RCRA Subtitle C and therefore are regulated under Phase I) • Temporary offsite waste storage sites
vi	• Interim recycling facilities (collection sites, satellite storage sites)
vi	• Facilities that generate electricity, but do not use steam electric generation
viii	• General equipment and vehicle storage/maintenance yards (municipal fire trucks, police cars, park maintenance; construction equipment yards) • Vehicle maintenance of garbage collection trucks owned by landfill operator • SIC 40-45 facilities without vehicle maintenance • Material handling/storage areas at SIC 40-45 facilities • School bus maintenance facilities owned or operated by school districts • Mining related equipment maintenance • Warehouses under SIC 4226 that do not have vehicle maintenance • Petroleum product wholesalers (SIC 5172) and bulk stations (SIC 5171) without vehicle maintenance
ix	• Treatment works with design flows less that 1 MGD (Transportation Act of 1991 exempted POTWs owned or operated by municipalities with population of less than 100,000) • Off-site non-domestic sewage treatment plants and sludge drying beds • Portable sanitary and septage service facilities • Water treatment plants
x	• Construction operations that result in the disturbance of less that five acres of total land area are under review due to the court opinion in *Natural Resources Defense Council* v. *EPA*, 966 F.2d 1292 (9th Cir. 1992)
xi	• Facilities where there is no exposure of material are under review due to the court opinion on *Natural Resources Defense Council* v. *EPA*, 966 F. 2d 1292 (9th Cir. 1992)

- **Auxiliary Facilities or Secondary Activities**—SIC codes are assigned on the basis of the primary activity from a financial standpoint that is taking place at a particular facility. Facilities with industrial activities that are in support of, or auxiliary to, a non-regulated activity would not be covered under Phase I. Examples include maintenance of construction equipment and vehicles and local trucking for an unregulated facility (grocery stores etc.).

- **Facilities Intentionally Omitted from Phase I**—Another class of facilities which are not addressed under Phase I are those that are related to, but were intentionally omitted from, one of the 11 industrial categories. For example, category ix does not cover treatment works with a design flow of less than 1 MGD, and category v does not address landfills that have not received industrial waste. While these activities may be slightly different from Phase I activities in size, scope, or specific materials present, there are many similarities which may make these facilities a potential concern in Phase II.

- **Facilities Exempted by the Transportation Act**—The Intermodal Surface Transportation Efficiency Act of 1991 (Transportation Act) exempted most industrial activities owned or operated by municipalities of less than 100,000 people from permit coverage under Phase I.[7] This exemption applies to approximately 19,000 incorporated places and 17,000 minor civil divisions in over 3000 counties. It is important to note that these activities are identical to Phase I facilities and are not located in municipalities which are covered under Phase I.

The overlap in SIC code assignments between Group A facilities and Phase I regulated activities make accurate estimation of the number of facilities in Group A very difficult. The estimates used are based on a process of elimination. Beginning with the total number of facilities in SIC codes 10-45 and subtracting the number of facilities accounted for under Phase I gives approximately 100,000 to 200,000 facilities. This is roughly equivalent to the size of Phase I. The difficulty in distinguishing these facilities from their closely related Phase I analogues also makes the geographic analysis conducted in section 4.2 difficult. Although the analysis has been conducted on a general basis for the entire group, this will only yield an overall approximation. Sub-classes of facilities within this group may be

[7] The Transportation Act exempted industrial activities owned or operated by municipalities of less than 100,000 population from Phase I permitting requirements with the exception of powerplants, airports, and uncontrolled sanitary landfills.

distributed quite differently. For information on the distribution of specific two-digit SIC codes within group A, see Appendix G.

Group B Sources

Based on the regulatory review and analysis of the types of industrial sources not covered under Phase I (discussed previously), several categories of facilities that are inherently similar or related to Phase I sources, but that fall into SIC code categories outside of SIC codes 10-45, were identified. A number of criteria were used to develop a comprehensive list of facilities which should be considered for inclusion in Phase II. This list constitutes Group B.

The first criteria used to identify Group B facilities were activities with industrial components or closely related activities. The main categories identified include:

- **Transportation Activities and Services**—SIC series 478x, which are similar to those identified in Category viii of the Phase I definition (see Table 4-2)
- **Energy Producers and Distributors**—Similar to Categories iii and vii, including pipelines (SIC 461x) and petroleum producers (SIC 4925)
- **Other Utilities**—Water supply, irrigation, and sanitation services that may often be municipally operated (SICs 494x, 495x, and 497x), which are related to Category ix
- **Municipal or Governmental Activities or Services**—In the 922x series that may have industrial components (Category ii) or activities related to transportation or vehicle maintenance (Category viii) (e.g., police stations, jails, and fire stations).

The next criterion used was commercial facilities with industrial components or similar operations. Commercial facilities were specifically excluded from Phase I by congressional intent. However, officials engaged in controlling urban runoff and nonpoint source pollution at the local, State, and national level believe that many commercial sources represent an important environmental concern. These concerns are documented in State and local nonpoint source programs, urban runoff programs, and estuary programs identified through

the literature review. The Rensselaerville Study (1992) reflected potential areas of concern by identifying "gas, auto, service stations, transportation related activities, highway systems, land development, agricultural sources and related activities, commercial activities with industrial components, and large retail complexes."[8] Taking a broad view of these descriptions, facilities were identified in two main categories. The first category comprises commercial or retail establishments with industrial components or activities:

- Many types of establishments that provide automotive or transportation services, including car dealers and gas/service stations (SICs in the 55xx series) and other automobile-related services and maintenance with SIC codes from 751x to 754x, such as truck and car renters, various types of repair and body shops, parking structures, and car washes

- Commercial enterprises involved in fuel wholesaling and distribution, such as gas and petroleum storage and distribution (SICs 493x and 517x) and fuel oil and coal dealers (SIC 598x)

- Commercial or wholesale enterprises with manufacturing or assembly activities, mainly in the 50xx and 52xx series

- Commercial or wholesale facilities that include food processors or wholesalers that may have organic wastes (SIC 514x), photographic studios (SIC 7221) and photo finishing labs (SIC 7384), small repair shops that may have metal wastes (SIC 769x), including repair of communications devices, refrigeration units, other electrical or electronic devices, and welding; research and testing laboratories (SIC 873x) and laundries (SIC 721x)

- National security entities (SIC 9711); although industrial activities at military facilities are regulated in Phase I, potential Phase II activities may be located on these sites as well and would not show up individually in the analysis that follows.

The second category consists of commercial or retail facilities and other sources that are similar or related to agricultural activities or sources and includes:

[8] No SIC codes specifically identify all large retail complexes. However, these are partially addressed through the loading analysis of storm water from urban/urbanized areas in the municipal section (Chapter 3). If such items were to be addressed in a regulatory framework, it would likely be on the basis of a narrative description rather than a SIC designation.

- Agriculture-related operations in the SIC groups 021x and 025x because they may represent confined animal facilities or feedlots.[9] Wholesale livestock facilities (SIC 5154) were also included under this criterion as were animal husbandry operations aside from general farms, such as zoos (SIC 8422), racetracks and stables (SIC 7948), which may have operations that are similar to feedlots.

- Because of potential for use of pesticides and fertilizers, the following were included: nurseries and lawn and garden facilities (SIC 078x) and other facilities that may store, mix, or use agricultural chemicals or other pesticides, such as farm products and raw materials sellers (SIC 5159), wholesalers of chemicals and allied products (SIC 5169), farm suppliers (SIC 5191), lawn and garden suppliers (SIC 5261), and exterminators (SIC 7342).

- Other facilities that may use pesticides or fertilizers in substantial quantities, such as golf courses and other recreational establishments with large lawns (SIC 799x) and colleges and schools (SIC 822x), which may have lawns, gardens, nurseries, or experimental agricultural areas. (These may also operate power plants or treatment works or engage in other activities similar to regulated industrial categories.)

From the 12 categories of Group B Phase II sources identified above, the universe of facilities was screened to identify a specific subset for further analysis. Through this selection process, potential Phase II facilities were identified, including those associated with products or waste materials that contain pollutants, such as metals, pesticides, and nutrients, and those associated with processes, practices, or events that can lead to the discharge of those pollutants into storm water. The SIC manual identifies 83 major groups of SIC codes in 10 major divisions (identified in Table 4-1). These major groups are divided into 1,047 four-digit categories. Of these, 604 fall into Phase I regulated activities or closely related facilities which make up Group A (SIC 10-45). Of the 443 that remain in agricultural, commercial, and retail divisions, 168 fall into the excluded service sectors. Of the remaining 275 categories, the screening process and the 12 categories identified above correspond to 90 individual categories of facilities and activities for further study as potential Phase II sources.

[9] See footnote 4 regarding feedlots currently regulated under the NPDES program.

This subset of 90 four-digit SIC codes is listed in Table 4-4. More than a million facilities were identified for these SIC categories by searching EPA's Facility and Company Tracking System (FACTS) data base.[10]

To facilitate analysis, some additional grouping is necessary. These 90 individual categories could be grouped together based on the 12 criteria used to identify them. However, some of the criteria group together dissimilar activities. For example, "commercial wholesalers" include four dissimilar categories: wood, ore, metal, and machinery wholesalers. Based on these distinctions, the 12 groups were further subdivided, forming 18 potential Phase II sectors. The 18 sectors are listed in Table 4-5. The affiliation of each specific SIC code with a sector is shown in Table 4-4, along with the numbers of facilities in that SIC code. This grouping into sectors facilitates discussion of similarities and differences among categories later in the chapter.

The data on numbers of facilities in Table 4-4 reveal some interesting facts about individual categories. Of the 18 Group B sectors, the automobile service sector (comprised of gas/service stations (SIC 5541), general automobile repair (SIC 7538), top, body repair (SIC 7532), repair shops and services (SIC 7699), car dealers, new & used (SIC 5511), car dealers, used only (SIC 5521), car washes (SIC 7542), passenger car rental (SIC 7514), truck rental (SIC 7513), parking structures (SIC 7521), and miscellaneous auto services (SIC 7549)) make up more than one-third of the total number of facilities identified in all 18 sectors.

Table 4-5 also shows facility counts for the 18 Group B sectors, illustrating even more clearly the dominant categories. Facilities engaged in automotive service and vehicle maintenance are far more numerous than other groups of potential Phase II sources. Machinery and electrical repair facilities are the second largest group, and intensive users of agricultural chemicals, including lawn and garden establishments and nurseries, are the third largest group.

[10] As discussed in Chapter 2, the FACTS data base is leased by EPA from Dun & Bradstreet Information Services, which created, maintains, and annually updates information based on a variety of sources.

Table 4-4. SIC Codes Selected for Study Based on Screening Procedure

SIC Code	Description Selected (90) 4-Digit Code	Number of Facilities	Phase II* Sector
5541	Gas/Service Stations	91,924	Automotive Service
7538	General Auto Repair	87,994	Automotive Service
7699	Repair Shops & Related Svcs., NEC	70,095	Machinery & Electrical Repair
7532	Top, Body Repair	48,800	Automotive Service
5084	Industrial Mach. & Equipment	38,880	Wholesale, Machinery
5511	Car Dealers, New & Used	37,387	Automotive Service
0782	Lawn & Garden Services	36,369	Intensive Ag. Chemical Use
5211	Lumber & Bldg. Materials	34,757	Wholesale, Wood Products
5521	Car Dealers, Used Only	32,145	Automotive Service
7539	Specialized Repair	26,381	Automotive Service
7216	Dry Cleaning	22,042	Laundries
7622	Radio and Television Repair	20,527	Machinery & Electrical Repair
5191	Farm Supplies	20,189	Intensive Ag. Chemical Use
7221	Photographic Studios	20,010	Photographic Activities
9629	Electrical Repair Shops, NEC	19,448	Machinery & Electrical Repair
5261	Lawn & Garden Supply	19,443	Intensive Ag. Chemical Use
5085	Industrial Supplies	17,869	Wholesale, Machinery
0212	Beef Cattle, not Feedlots	14,684	Livestock, Feedlots
7692	Welding Repair	14,305	Machinery & Electrical Repair
5031	Lumber, Millwork	13,836	Wholesale, Wood Products
5083	Farm Mach. & Equip.	13,670	Wholesale, Machinery
7217	Carpet Cleaners	13,636	Laundries
7549	Misc. Automotive Services	13,571	Automotive Service
7542	Car Washes	12,842	Automotive Service
7342	Disinfect/Exterminating	12,359	Intensive Ag. Chemical Use
4731	Arrangement Freight Trans.	12,303	Transport, Rail and Other
0241	Dairy Farms	12,298	Livestock, Feedlots
5172	Petroleum Products/Dist.	11,128	Petrol. Pipelines & Distributors
0181	Ornamental Nurseries	11,019	Intensive Ag. Chemical Use
4953	Refuse Systems	10,797	Various Utilities
7384	Photo Finishing Labs	10,674	Photographic Activities
5169	Chem & Allied Prod, NEC	10,355	Intensive Ag. Chemical Use
5051	Metal Service Centers	10,267	Wholesale, Metal Products
7623	Refrig. & Air Condition. Repair	8,504	Machinery & Electrical Repair
5171	Petroleum, Bulk	8,086	Petrol. Pipelines & Distributors
7514	Passenger Car Rental	7,939	Automotive Service
7513	Truck Rental	7,799	Automotive Service
7212	Garment Cleaners	7,280	Laundries
0783	Shrub & Tree Services	7,260	Intensive Ag. Chemical Use
5983	Fuel Oil Dealers	7,233	Petrol. Pipelines & Distributors
5082	Constr. & Min. Mach.	7,143	Wholesale, Machinery
8221	Colleges and Universities	6,829	Extensive Ag. Chemical Use
8731	Comm. Research Labs	6,382	Laboratories
5984	Fuel and Coal Dealers	6,226	Petrol. Pipelines & Distributors
5147	Meat & Products	5,298	Wholesale, Food
4941	Water Supply	4,904	Various Utilities

Table 4-4. SIC Codes Selected for Study Based on Screening Procedure (continued)

SIC Code	Description Selected (90) 4-Digit Code	Number of Facilities	Phase II* Sector
8249	Vocational Schools	4,647	Extensive Ag. Chemical Use
5146	Fish & Seafoods	4,579	Wholesale, Food
7219	Laundry Services	4,575	Laundries
5154	Livestock	4,351	Livestock, Feedlots
0213	Hogs	4,328	Livestock, Feedlots
8734	Testing Laboratories	4,301	Laboratories
7992	Golf Courses, Public	4,295	Extensive Ag. Chemical Use
5039	Construct Materials	4,036	Wholesale, Metal Products
9511	Air, H_2O & Solid Waste Mgmt.	3,688	Various Utilities
7521	Parking Structures	3,088	Automotive Service
0211	Beef Cattle Feedlots	2,972	Intensive Ag. Chemical Use
7211	Laundries	2,940	Laundries
7694	Armature Rewinding Shops	2,865	Machinery & Electrical Repair
9221	Police Protection	2,508	Munic. Services, Vehicle Maint.
9711	National Security	2,414	National Security
7948	Race Tracks/Stables	2,271	Livestock, Feedlots
5159	Farm Prods. Raw Mats	1,895	Intensive Ag. Chemical Use
4959	Sanitary Svcs., NEC	1,894	Various Utilities
8222	Junior Colleges	1,850	Extensive Ag. Chemical Use
9223	Jails	1,714	Munic. Services, Vehicle Maint.
5144	Poultry & Products	1,495	Wholesale, Food
5052	Coal/Minerals & Ores Wholesale	1,384	Wholesale, Coal & Ores
7996	Amusement Parks	1,371	Extensive Ag. Chemical Use
0252	Chicken Eggs	1,171	Livestock, Feedlots
0219	General Livestock, not Dairy	1,160	Livestock, Feedlots
4783	Packing and Crating	1,099	Transport, Rail and Other
5989	Fuel Oil Dealers, NEC	1,075	Petrol. Pipelines & Distributors
0251	Broiler, Fryer, Roaster Chicken	941	Livestock, Feedlots
7218	Ind. Launderers	903	Laundries
4789	Transport Services, NEC	899	Transport, Rail and Other
0254	Poultry Hatcheries	719	Livestock, Feedlots
4971	Irrigation System	662	Various Utilities
0214	Sheep and Goats	618	Livestock, Feedlots
4925	Gas Producers, Distributors	604	Petrol. Pipelines & Distributors
0273	Animal Aquaculture	595	Livestock, Feedlots
4612	Crude Petroleum Pipelines	390	Petrol. Pipelines & Distributors
9229	Fire Protection	389	Munic. Services, Vehicle Maint.
4613	Refined Petroleum Pipelines	347	Petrol. Pipelines & Distributors
4785	Weighing: Vehicle Trans.	332	Transport, Rail and Other
4939	Utilities, NEC	297	Various Utilities
8422	Botanical Gardens & Zoos	285	Livestock, Feedlots
4932	Gas & Service	212	Petrol. Pipelines & Distributors
4741	Rental of Railroad Cars	175	Transport, Rail & Other
4619	Pipelines, NEC	18	Petrol. Pipelines & Distributors
	TOTAL	1,015,239	

*Phase II sector is a grouping devised to facilitate discussion of similar facilities. The sectors are further described in the text and summarized in Table 4-5.

Table 4-5. Summary of Group B Phase II Sectors

Description of Phase II Sectors	No. of Facilities
Automotive Service	369,870
Machinery & Electrical Repair	135,744
Intensive Ag. Chemical Use (a)	121,861
Wholesale, Machinery	77,562
Laundries	51,376
Wholesale, Wood Products	48,593
Livestock, Feedlots	43,421
Petroleum Pipelines & Distributors	35,319
Photographic Activities	30,684
Various Utilities	22,242
Extensive Ag. Chemical Use (b)	18,992
Transport, Rail and other	14,808
Wholesale, Metal Products	14,303
Wholesale, Food	11,372
Laboratories	10,683
National Security	4,611
Municipal Services, Vehicle Maint.	2,414
Wholesale, Coal & Ores	1,384
Total	1,015,239

(a) e.g., nurseries, farm chemical suppliers & distributors
(b) e.g., large lawns, golf courses

Remaining Phase II Activities

The identification of all Phase I facilities together with facilities in Groups A and B only account for approximately 1.5 million of the estimated 7.7 million total facilities. This leaves over 6 million facilities "unaccounted for" in this analysis. These remaining facilities include a wide range of activities which fall into a number of general classifications.

General Sources—Widespread sources of potential storm water contamination which are not necessarily associated with any one particular activity are a large category of sources not addressed in this analysis. These include parking lots, trash dumpsters, leaking and failing septic systems, and activities related to individual residences such as fertilizer and pesticide application. The tremendous number of these sources would make individual permitting virtually impossible. Although the identification and analysis of individual Phase II sources does not focus on these sources, the municipal analysis does account for pollutant loadings from these types of sources which are related to the general process of urbanization.

Service Sectors—Major SIC groups in the service sectors, such as banking, finance, insurance firms, and all types of food services were not considered to be potential Phase II sources. The activities of these enterprises are generally conducted indoors and do not inherently use or produce contaminants that may enter storm water. However, these facilities may also have some of the general sources of storm water contamination discussed above, such as parking lots or trash dumpsters. All of the major SIC groups excluded on this basis are listed in Table 4-6. Although the analysis of this report does not focus on service sector facilities in detail at the four-digit SIC level, the geographic and distributional analysis was conducted for these facilities at the major group (two-digit SIC) level. These results are presented in Appendix G.

4.2 NATURE AND EXTENT OF POLLUTANTS ASSOCIATED WITH INDIVIDUAL PHASE II SOURCES

This section responds to the second congressional mandate in CWA Section 402(p)(5): to determine the nature and extent of pollutants in storm water discharges to the maximum extent practicable. EPA developed quantitative and qualitative information on the types of activities or materials associated with potential Phase II sources and their locations relative to various geographic jurisdictions.[11]

The nature of storm water discharges from industrial and commercial sources was addressed in two ways. First, sampling data on quality of runoff from Phase I industrial sources were analyzed and summarized to provide a basis of comparison for potential Phase II sources. The data submitted with group permit applications are among the most comprehensive sources of data on pollutant concentrations in industrial runoff. Second, descriptive information on the potential for storm water discharges from industrial and commercial activities was identified and summarized. This was based on the literature review, inference from descriptions of the activities associated with industrial and

[11] As discussed in Chapter 2, EPA was not able to identify adequate data to support the calculation of pollutant loadings on a national scale.

Table 4-6. SICs Not Considered as Potential Phase II Sectors

Transportation and Public Utilities Sector: SIC 48 Communication Facilities
Retail Trade Sector: SIC 53 General Merchandise Stores 54 Food Stores 56 Apparel and Accessory Stores 57 Home Furniture, Furnishings and Equipment Stores 58 Eating and Drinking Places
Finance, Insurance, and Real Estate Sector all facilities: SIC 60 Banking 61 Credit Agencies 62 Security Brokers 63 Insurance Carriers 64 Insurance agents 65 Real Estate 67 Investment Offices
Services Sector: SIC 70 Hotels and Lodging Places 78 Motion Pictures
Health Services Sector: SIC 80 Doctors' Offices and Medical Clinics 81 Legal Services 83 Social Services 86 Membership Organizations 88 Private Households with Employees
Public Administration Sector: SIC 91 General Government, Except Finance 93 Public Finance and Taxation 94 Administration of Human Resource Programs 96 Administration of Economic Programs

Source: OMB, 1987

commercial facilities, the documented experiences of municipalities operating storm water management programs, and EPA's experience in assisting the regulated community in meeting group application requirements under Phase I of the regulatory program.

Determining the extent of pollutants was addressed by identifying the geographic distribution of the sources that may contribute pollutants to storm water. Through a locational analysis, categories of facilities were analyzed to determine to what extent they are located in various sizes of cities, urban areas, and other political jurisdictions. This quantitative assessment of location is informative and useful for certain policy discussions but

does not establish the presence of pollutants in storm water for any potential Phase II sources.

4.2.1 Nature of Pollutants Associated With Individual Phase II Sources

This section presents information on pollutants and activities associated with industrial, commercial, and retail categories that may contribute to storm water contamination.

4.2.1.1 Phase I Industrial Group Applicant (Part II) Data

Phase I Industrial Group Applicant (Part II) Data provides a basis for identifying the areas and activities that may be of concern when associated with nonregulated categories of facilities. This section presents analyses of storm water runoff quality data from Phase I (industrial) permit applicants. As part of the permitting process, 44,000 Phase I group applicants in 700 groups were organized into 29 sectors based on general similarity for purposes of writing a multisector general permit.[12] Part II of the permit application required approximately 10 percent of the members of each group to submit sampling results for pollutants in storm water discharges, including conventional, nutrients, and other toxic pollutants that might be present. Table 4-7 summarizes these results by reporting the composite sample mean concentration for each sector for nine of the basic pollutants studied in NURP plus oil and grease. Although the sources and methods of data collection differ, this industrial sector concentration data can be compared with summary data from NURP or USGS to provide some insight into storm water runoff quality. Comparisons can also be made among sectors to determine which are more likely to discharge higher concentrations of certain classes of pollutants. Appendix E provides a comprehensive summary of the industry sectors and sampling data from the group application process.

[12] The sectors were designed to group similar facilities together. Facilities were separated into 31 sectors for analysis of the Part II Group Application data for this report. Only 29 sector permits were developed in the multi-sector general permit. After some groups were combined, and others withdrew, only 700 groups representing 44,000 facilities remained from approximately 60,000 which began the group application process.

Table 4-7. Summary of Sampling Data from Phase I Group Permit Applications (with comparison to NURP and USGS studies[1])

		Pollutant Composite Mean (mg/l)									
		Conventionals				Nutrients			Metals		
Sector	Description	BOD5	COD	TSS	O&G	NO2+3	TKN	P	Copper	Lead	Zinc
NURP	Median Urban Site *	12	82	180	NR	0.86	1.90	0.42	0.04	0.18	0.20
USGS	Commercial Site *	16	NR	248	NR	0.38	NR	0.31	0.03	0.22	0.31
01	Lumber & Wood Products	45.37	242.50	575	2.54	0.75	2.32	6.29	0.05		0.36
02	Paper & Allied Prod.	24.25	133.90	44		0.76	3.17	0.36	0.03	0.03	0.78
03	Chemicals & Allied Products	11.74	77.24	94	0.19	4.29	17.75	9.51	0.12	0.02	1.74
04	Petrol Refining & Related Ind.	10.87	86.93	165	0.00	0.82	1.63	0.28			
05	Stone, Clay, Glass Products	7.32	77.53	386	1.55	1.40	2.37	0.87	0.16	0.25	0.39
06	Primary Metal Ind.	34.08	109.84	162	2.97	1.38	3.00	0.52	2.25	0.19	6.55
07	Metal Mining	10.63	195.07	623		0.90	3.39	1.06	0.59	6.07	3.87
08	Coal & Lignite Mining	6.55	26.86	690		1.00	2.65	0.12	0.00		0.06
09	Oil & Gas Extraction	10.59	115.94	413	2.14	0.60	1.69	3.41			
10	Nonmetallic Mineral Mining	6.89	66.20	1576	0.00	1.27	2.41	1.13	0.01		0.29
11	Hazardous Waste TSDFs	9.44	51.93	83		0.39	1.07	0.11			
12	Industrial Landfills & Dumps	9.04	102.02	1850		1.38	3.03	0.95		20.64	
13	Used Motor Vehicle Parts	11.77	66.23	839		1.62	2.27	2.23		0.88	
14	Scrap & Waste Materials	24.00	203.71	376	1.06	5.88	3.38	0.77	0.63	0.02	3.35
15	Steam Electric Power Plants	5.69	69.47	212	2.90	0.75	1.95	0.63	0.03		0.37
16	Railroad Transport	9.27	189.46	249		1.41	2.48	0.92		0.01	0.28
17	Transport: Trucks, Freight, etc.	11.07	85.64	454	5.28	1.99	2.04	0.73	0.02	0.05	1.34
18	Water Transport	6.00	75.79	224		0.66	9.41	0.15		0.09	0.42
19	Ship & Boat Building, Repair	6.27	69.96	45		0.82	2.20	0.86	0.08		0.33
20	Air Transport	21.34	75.63	80	6.36	1.29	16.00	0.29	0.01	0.01	0.35
22	Wastewater Treatment	46.11	187.09	114	2.96	20.50	4.74	0.68	0.05	0.01	0.12
23	Food, Tobacco Manufact.	42.54	141.65	200	5.03	0.98	4.07	1.32	0.05	0.04	0.79
24	Textile & Apparel Manufact.	9.82	48.05	80		1.14	1.92	0.31	0.07	0.01	0.30
25	Furniture & Fixtures	8.80	76.33	143		1.51	4.40	0.26	0.00		0.59
26	Printing & Publish.	6.95	42.37	31		1.35	1.57	0.35	0.02	0.01	0.47
27	Rubber & Plastic Prods.	11.21	72.08	119	1.56	1.26	1.63	0.34	0.03	0.02	0.80
28	Leather/Products	22.32	91.94	115	0.00	1.88	6.22	0.83		0.06	
29	Fabricated Metal Prod., Jewelry	10.04	86.17	125	6.83	1.27	1.78	0.84	0.46	0.22	2.17
30	Ind. & Comm & Transport Equip.	7.32	46.09	97	0.00	1.28	1.76	0.39	0.08	0.01	0.42
31	Electronic Equip & Instruments	7.48	36.32	67	3.40	0.66	1.34	1.02	0.01	0.14	0.15
33	Military Indust. Activities	16.51	54.50	126	3.68	0.88	1.28	7.12	0.17		0.68

*Recently, concerns have been raised regarding the validity and use of historical data for metals. As discussed in chapter 2, EPA believes that historical data on storm water runoff from NURP and USGS are suitable for the purposes of this report.

Although it focuses on Phase I sources rather than Phase II, this analysis is an important contribution to the literature and this report because it may be the most comprehensive data available on sector-specific industrial discharges. This information can assist EPA and States in evaluating and targeting Phase II sources, at least those that may be similar to Phase I sources. The information can also be used to compare with other sources of information and to give some perspective on which Phase II sectors are of most concern (to the extent they are similar to Phase I activities). This exercise also demonstrates the usefulness of the data

collection effort involved in the group application process. These summary data can also provide a baseline from which to measure future improvements in runoff quality and a basis for developing measurable indicators for performance evaluation of State, local, or industrial programs in the future.

An understanding of the group application sampling data is necessary. EPA approved facilities chosen for sampling within a group (ranging from 50 percent of small groups to 10 percent of large groups but no more than 100 facilities per group) only if they were representative, based on industrial activity, significant materials exposed, and geographic distribution. All data received from samplers were checked and double key punched and verified during entry.[13] At the same time, it is important to understand that the facilities submitting sampling data were not randomly selected but rather were identified by the group applicants. These facilities also chose the sampling locations at their sites and conducted monitoring in accordance with EPA guidance on the selection of suitable locations, storm events, and methodology.

In addition to the Phase I permit application data, historical data from past studies can provide some perspective on the nature of storm water from regulated and unregulated sources. Historical data on storm water quality from various types of sites from NURP and USGS were presented in Chapter 2. These data were collected from general urban, commercial, or industrial areas, not from specific industrial facilities. However, these data do provide useful historical reference points. In particular, the mean and median for the NURP urban site and USGS commercial sites were chosen for comparison with the new industry-specific data from permit applications. These levels provide a reference point based on past studies of the nature of storm water discharges. The pollutant concentrations observed in the NURP study should not be considered to be "acceptable" or normal levels of storm water contamination.

[13] Only those applications received before January 1993 are included in the data base used in this analysis.

Permit application data were analyzed for 11 pollutants, including 9 pollutants studied in NURP—biochemical oxygen demand (BOD), chemical oxygen demand (COD), total suspended solids (TSS), nitrate plus nitrite nitrogen, total Kjeldahl nitrogen (TKN), total phosphorus, copper, lead, and zinc—plus oil and grease and pH. As discussed, Table 4-7 reports summary results for the composite mean from the permit application data for 31 Phase I sectors. Appendix F gives more detailed results for each pollutant and each industrial sector, including the mean, median, and 95th percentile, as well as the number of samples taken. To provide a basis for comparing across industrial categories, the mean of the composite sample results was chosen as an indicator of average storm water quality. Composite samples are preferable to grab samples for comparing average runoff conditions because grab sample results (also reported in the tables) may represent pollutant spikes, rather than more long term average storm conditions. The following paragraphs review these results.

Conventionals

Among the conventional pollutants, total suspended solids appears to be the pollutant with highest concentration. Half of the Phase I industrial sectors had concentrations higher than NURP and average results in the hundreds of parts per million are common. Composite mean concentrations were over 1,500 mg/l for mineral mining and for landfills. These data confirm the result in NURP and other literature that sediment is an important component of storm water runoff. It should be noted that sediments can also carry additional pollutants, such as metals and organics. As reported on Table 4-7, COD results for the composite mean are higher than NURP in about half of the sectors (14 sectors out of 31). The highest reported composite mean value for COD was 242 mg/l and five sectors had concentrations greater than 150 mg/l, including lumber and wood products, scrap and waste materials, metal mining, railroad transport, and wastewater treatment. All sectors had concentrations higher than the average of commercial sites found in USGS studies. Results for BOD indicate that average runoff quality is not appreciably higher than the secondary treatment standard for POTWs of 30 mg/l. Although 10 sectors have higher levels of BOD than reported in NURP

and USGS, the highest composite mean value for BOD was 46 mg/l. Most results for pH (reported in Appendix F) are in the range of 6.8 to 8.5, indicating that acidity or alkalinity is not the greatest concern associated with runoff from these industrial sites. For oil and grease, composite results are highly variable, and neither NURP nor USGS provides a baseline for comparison. The highest concentrations, over 5 mg/l, are engaged in industrial sectors associated with transportation and vehicle and machinery maintenance, as might be expected.

Nutrients

Overall, storm water discharges from industrial sites do not appear to be contributing high concentrations of nutrients. Results reported in Table 4-7 indicate that concentrations for TKN exceed NURP results in 22 cases, including wastewater treatment plants, chemical manufacturers, scrap yards, mining sectors, transportation sectors, and leather manufacturers. However, most of the results were in the range of 2 to 5 mg/l. Concentrations (for the composite mean) over 16 mg/l were reported for the chemical and allied products sector and the air transport sector. Concentrations of nitrogen in the form of nitrates and nitrites for the industrial sites represented in the permit application data are generally in the range of 0.8 to 2.0 mg/l, but there are some important exceptions. The highest concentrations for the composite mean occurred in the wastewater treatment sector (20.5 mg/l) and the scrap and waste materials sector (5.9 mg/l). Phosphorus results also do not show generally high concentrations; only nine sectors had composite mean results over 1 mg/l. The highest concentrations occurred for chemical and allied products manufacturers (9.5 mg/l), military facilities (7.1 mg/l), lumber and wood products manufacturers (6.3 mg/l), and oil extractors (3.4 mg/l). In summary, nutrient concentrations exhibit a mixed pattern across industrial groups, with some very low and very high results. Results for the two forms of nitrogen and for phosphorus indicate that storm water discharges of nutrients tend to be site- and pollutant-specific. That is, discharge of one form of nutrient does not in general indicate that other forms are present or suspect, although the chemical and allied products sector is associated with all three.

Metals

Because sampling for metals proceeded on the basis of whether individual facilities had reason to believe they were present in their discharge, not all sectors reported results for metals. Again, referring to Table 4-7, results for copper show that 13 sectors had composite mean concentrations higher than NURP. The highest of these included the primary metals sector (2.25 mg/l) and scrap and waste materials (0.63 mg/l). Eight sectors reported no sampling results for copper. For lead, the table shows that the majority of sectors (15 out of 23) had concentrations below the mean value reported in NURP (0.18 mg/l). However, two of those with higher concentrations had extremely high values: the highest concentrations of lead found in industrial runoff were associated with industrial landfills and dumps (20.6 mg/l) and metal mining (6.1 mg/l). The next highest values came from the scrap and waste materials sector (.88 mg/l) and the stone, clay, and glass products sector (.25 mg/l). Results for zinc show that most of the sectors (22 of 25) had composite mean concentrations higher than the 0.20 mg/l value reported in NURP for general urban runoff. Nineteen sectors had concentrations higher than the 0.31 mg/l value reported in USGS studies for commercial sites. The highest concentrations found were associated with the primary metals (6.6 mg/l), metal mining (3.9 mg/l), and scrap and waste materials (3.6 mg/l) sectors. Six sectors did not report results for zinc. In summary, higher concentrations of metals tended to be associated with the primary metals sector, metal mining, industrial landfills, scrapyards, and metal fabricators.

4.2.1.2 Qualitative Assessment of Potential Phase II Categories

The sampling data presented previously were used to assist in understanding the nature of storm water discharges in Phase II sectors. To facilitate comparison of potential Phase II sources with the sampling results reported above, where possible, categories of Phase II sources were compared to similar Phase I sectors. These comparisons were made qualitatively and are not meant to suggest that the sectors conduct exactly the same activities or operations. Similarities were identified for 12 of the 18 Phase II sectors, as summarized in Table 4-8. The remaining categories of potential Phase II sources were generally not

classifiable based on similarities to Phase I sources. Using this correspondence to Phase I and information from the literature review, a summary table was developed showing the potential pollutants associated with each of the potential Phase II sectors. For some sectors, permit application data were used as the basis for determining which pollutants could be present. For other sectors, literature review information and other documents were used. This information is summarized in Table 4-8, which can be used as a guide to the possible presence of pollutants at Phase II facilities. This does not indicate that the pollutants will be found in substantial quantities or that water quality will be impaired. In particular, pollutants are associated with categories similar to Phase I facilities based on the fact that the Phase I sector had among the highest (top ten) concentrations of that pollutant. Thus, it is based on a relative ranking: an industrial category may be among the highest, even when overall concentrations are not very high.

Based on the literature review, assessments of SIC descriptions, the selection criteria outlined above, and the pollutant data summarized in Table 4-8, information about the 18 potential Phase II categories can be summarized into several major groups. The first major group includes facilities with activities similar to those regulated under Phase I, even though they may be small commercial or retail establishments, rather than industrial ones. This class includes about 80 percent of the potential Phase II sources. One of the chief activities of concern in this group is vehicle maintenance and related transport, storage, and machine repair activities. Other activities conducted at these facilities that are substantially similar to those already regulated include loading and unloading operations, which include pumping of gases or liquids, pneumatic transfer of dry materials, or transfer of containers to or from vehicles; outdoor storage, including storage of fuels, raw materials, byproducts, intermediates, final products, and process residuals or wastes; and other outdoor activities and land disturbing operations, such as small construction and landscape maintenance. The types of products or waste materials at facilities in this class could include a wide variety of materials that potentially contribute pollutants to storm water runoff. Although discharges could include the whole range of pollutants, these sources may be more likely to contribute

Table 4-8. Correspondence Between Potential Phase II Sectors and Phase I Sectors and Potential Pollutants of Concern

Description	Rank by # of Facilities	Corresp. to Phase I	Potential Pollutants of Concern						Pesticides & Toxics
			Conventionals			Nutrients		Metals	
Phase II "Sectors"		Sectors	B/COD	TSS	O&G	N	P		
Automotive Service	369,870	17, 13		X	X	*	*	X	S
Machinery & Electrical Repair	135,744	31			X		*		
Intensive Ag. Chemical Use	121,861	NA	S	S		S	S		S
Wholesale, Machinery	77,562	30			S			X	
Laundries	51,376	NA	S			S	S		
Wholesale, Wood Products	48,493	1	X	X			*		
Livestock, Feedlots	43,421	NA	S	S		S	S		
Petrol. Pipelines & Distributors	35,319	9, Other				*	*	X	S
Photographic Activities	30,684	NA	S					S	S
Various Utilities	22,242	11, 12, 22	X	X	X	*		X	
Extensive Ag Chem Use	18,992	NA	S	S		S	S		S
Transport, Rail and Other	14,808	16	X	S	S	*		S	S
Wholesale, Metal Products	14,303	14	X		S	*		X	
Wholesale, Food	11,372	23	X	S	X	*	*	X	
Laboratories	10,683	NA	S						S
National Security	4,611	17, 29, 33		X	X	*		X	S
Munic. Services, Vehicle Maint.	2,414	17, 29	X	S	X		*	X	S
Wholesale, Coal & Ores	1,384	8		X			*		

X - Indicates similar Phase I sector ranked in top ten of all sectors for this pollutant class
S - Indicates pollutant is suspected, based on literature review and expert opinion
NA - Not applicable: No clear correspondence with Phase I Sectors
* - Overall, nutrient levels were not high in Phase I application data. This indicates that the pollutant was found in the top ten, but actual concentration levels were not high.
Blanks indicate that such pollutants are not pollutants of concern for the Phase II sectors.

toxics, in addition to conventionals and nutrients. Pollutants of concern include organic and inorganic chemicals; fuels, such as coal and oil; paints; metals; solvents; and oil and grease. Although not specifically addressed in this analysis, off-site storage and maintenance activities, which may be owned and operated by Phase I facilities but are not currently regulated, could also fall into this class.

The second major classification of facilities includes categories of industrial, commercial, or retail activities and businesses with discharges that may be similar to those from agricultural sources (which are exempt from NPDES regulation under the CWA). For example, smaller feedlots that are not currently regulated and large users of pesticides and fertilizers may be similar to agricultural discharges but are not specifically exempted by statute. This class of facilities includes more than 180,000 facilities or about 20 percent of

those selected for study. This group includes lawn and garden services (SIC 0782), farm supplies (SIC 5191), and lawn and garden supply (SIC 5283), which are among the largest SIC groups selected for study (see Table 4-4). Fertilizers and pesticides from these facilities have the potential to contaminate storm water from activities such as land application, spills and leaks, rinsing of containers and trucks, and improper disposal. Thus, the pollutants of concern include conventionals, pesticides, and nutrients that are associated with uses of open space that superficially resemble agricultural uses, such as lawn and landscape care or commercial/retail production, transport, or storage of nursery products.

The third major class of potential Phase II sources includes categories of facilities with the potential to use or produce toxic substances but about which there is little information. Research and development laboratories and some kinds of governmental activity (such as justice and public order facilities, SIC 92xx) fall into this category. Some of these facilities may be administrative centers with little potential to discharge pollutants. Others, such as police and fire protection services, however, may include vehicle maintenance activities with potential for discharges similar to those described above. This group includes about 20,000 facilities, representing only about 2 percent of those chosen for study.

This section described the categories of facilities and evaluated the nature of potential pollutant discharges qualitatively based on similarity to Phase I sources and information from storm water literature. However, from a national perspective, little quantitative information exists on discharge quality from these potential Phase II sources.

The majority of Group A facilities are so similar to Phase I activities that data collected from Phase I permit application data may be used to evaluate their pollution potential. There are also a very few classes of unregulated facilities for which some data is already available. One category of facilities for which substantial information is currently available is feedlots. Although feedlots which meet the definition of Concentrated Animal Feeding Operation (CAFO) are currently subject to NPDES permitting requirements, many smaller feedlots do

not meet the current regulatory definition of CAFO and hence are not subject to current NPDES regulations.[14]

The United States Department of Agriculture (USDA) has estimated that there are approximately 6,000 animal feeding operations with 1,000 or more animal units.[15] EPA's Permit Compliance System (PCS) data base indicates that, as of October of 1994, EPA and authorized States have individual permits covering 928 CAFOs and general permits covering at least another 2,130 facilities. The total number of NPDES permits for feedlots is significantly less than the approximately 6,000 facilities that have more than 1,000 animal units. The discrepancy between the number of facilities authorized to discharge by NPDES permits and the total number of feedlots over 1,000 animal units is believed to be due to a number of factors, including: (1) due to limited State and Federal resources, some feedlots that should have a permit have not been brought into the NPDES program; (2) some regulatory authorities misinterpret the Federal regulations for CAFOs and mistakenly exempt facilities that should have permits; and (3) permits are only required for facilities that discharge at times other than the event of a 25-year/24-hour storm. USDA estimates that there are approximately 378,000 animal feeding operations with less than 1,000 animal units but more than 20 animal units.

Animal feedlots contribute to a significant degree of water quality impairment. States report the scope and sources of water quality impairments under Sections 305(b) and 319 of the CWA. Information from these sources indicates that, nationally, feedlots cause 7 percent

[14] As discussed in Chapter 1, CAFOs are defined as animal feeding operations that discharge to waters of the United States at times other than during events greater than a 25-year, 24-hour storm and that: (1) have more than 1,000 animal units; (2) have more than 300 animal units and pollutants are discharged into navigable waters through a man-made flushing system or other man-made device, or pollutants are discharged directly into waters of the United States which originate outside of and pass over, across or through the facility or otherwise come into direct contact with the animals confined in the operation; or (3) are designated by EPA or an authorized NPDES State upon determining that it is a significant contributor of pollution to the waters of the United States.

[15] U.S. Department of Agriculture, Office of Budget and Policy Analysis, Draft Report, 1992. *Progress and Status of Livestock and Poultry Waste Management to Protect the Nation's Waters.*

of impairment in lakes and 13 percent of impairments in rivers.[16] Feedlot impact is less significant, on average, in estuaries and ocean coasts, although there are estuaries, such as the Chesapeake Bay and Puget Sound, where animal waste is a significant water quality problem. In addition, the U.S. Fish and Wildlife Service estimated in 1984 that feedlots impair fisheries in nearly 60,000 miles of streams nationally. EPA is unable to identify the relative contributions to impairment of facilities currently subject to NPDES permits and those that are not; however, waterbodies have been identified in case studies where impairment is due to smaller feedlots not subject to permits, e.g., the Chesapeake Bay.

Feedlots produce an estimated 400 million tons of animal waste per year, twice as much waste as humans produce. These wastes contain ammonia, phosphorus, nitrogen, oxygen demanding materials, and high levels of pathogenic bacteria. When used properly, animal wastes are a valuable resource, but when such wastes are discharged into surface or ground water, they often cause impairment.

High pollutant concentrations can be associated with feedlot runoff. Nutrients, oxygen demanding materials, and bacteria in runoff from feedlots are often present in concentrations that are 10 to 100 times those of untreated sanitary sewage[17] or combined sewer overflows.[18] Fish kills may result from runoff, wastewater, or manure entering surface waters, due to ammonia and dissolved oxygen depletion. The decomposition of organic materials can deplete dissolved oxygen supplies in water, resulting in anoxic or anaerobic conditions. Methane, amines, and sulfide are produced in anaerobic waters causing the water to acquire an unpleasant odor, taste, and appearance. Such waters can be unsuitable for drinking, fishing, and other recreational uses. Solids deposited in water bodies can

[16] *Water Pollution from Feedlot Waste: An Analysis of its Magnitude and Geographic Distribution*, EPA Feedlot Workgroup, December 1992.

[17] *Report of the EPA/State Feedlot Workgroup*, EPA Feedlot Workgroup, September 1993.

[18] *Water Pollution from Feedlot Waste: An Analysis of its Magnitude and Geographic Distribution*, EPA Feedlot Workgroup, December 1992.

accelerate eutrophication through the release of nutrients over extended periods of time. Animal diseases can be transmitted to humans through contact with animal feces. Animal waste has been responsible for shellfish contamination in some coastal waters.[19] Animal wastes discharged to waterways perform the same nutritional function for aquatic plants as they do for field crops, with high levels of nitrogen and phosphorus promoting algae growth in receiving waters. Pathogens, nitrates, and salts in manure can impair ground water, with problems being reported in at least 17 States.

4.2.2 Geographic Extent of Facilities

This section addresses the extent of potential Phase II facilities through a geographic analysis of their location with respect to urbanized areas, regulated Phase I municipalities, and other population centers. The procedures used to generate this information were discussed in Chapter 2. This analysis does not provide any information on the quantity or quality of storm water discharged by these facilities. This is locational data only. Some facilities may have completely enclosed operations. Some may be connected to sanitary or combined sewers, rather than to separate storm sewer systems. Finally, some may have few pollutants of concern in use or in their discharges.

Even so, determining location and geographic distribution lends some valuable insights. The location of facilities is important for both environmental and for policy reasons. From an environmental perspective, facilities located in populous, urban, or dense areas may be larger and more heavily used, with the potential for larger amounts or concentrations of pollutants to be discharged. At the same time, however, runoff from these urban facilities may be more likely to discharge to storm or sanitary sewers, where it will mix with other storm water flows before ultimate discharge to receiving waters. Facilities located in more rural areas may be no different in terms of pollutant content but may have a greater potential for discharging directly into the Nation's waters.

[19] *Guidance Specifying Management Measures for Sources of Nonpoint Pollution in Coastal Waters*, EPA, January 1993.

From a policy perspective, urban and rural storm water discharges could also be treated differently. Industrial, commercial, and retail facilities in urban areas will more often fall within the boundaries of a municipal storm water control program. Thus, any control, detention, or sampling efforts by municipalities may help to locate and mitigate the impact of the storm water discharges within their jurisdictions, whether these discharges are federally regulated or not. The rural discharger, on the other hand, is more likely to be a direct discharger or to be located in a smaller municipality with no storm water program and, thus, may be relatively uncontrolled unless located in a high priority watershed that receives special State attention.

As discussed in Chapter 2, Phase II of the storm water program could cover additional commercial sources directly through permitting requirements for individual facilities or indirectly by requiring local governments to address commercial sources. With respect to the second approach, there are many ways of expanding control strategies to additional geographic areas and political jurisdictions, beyond those covered in Phase I. For example, EPA could expand regulatory or control requirements to:

- The urbanized fringe around existing Phase I cities
- All urbanized areas not covered in Phase I
- Additional cities (incorporated areas) based on size
- Growing areas, where both development pressures and opportunities for preventive measures are greatest
- Coastal areas, where storm water quality impacts have been identified.

Of course, a combination of options can also be considered, such as urbanized areas in coastal areas or cities of a certain size in fast growing counties. To evaluate alternatives, consideration must be given to how industrial, commercial, and retail establishments are distributed in different jurisdictions, such as cities or urbanized areas of a certain size. The analysis on the following pages demonstrates how these various options would affect

industrial and commercial facilities (i.e., what portion of facilities in a given sector would be covered by a particular geographic approach). This analysis of location was completed for each of these perspectives. This section presents and discusses results for urbanized areas, primarily. Other relevant results are discussed in the text, but full numerical details are reported in Appendix G.

As discussed in Chapter 2, this presentation is based on the premise that individual commercial and retail activities are distributed similarly to the population at the county level. That is, if 40 percent of the people in a county live in urbanized areas, this analysis assumes that 40 percent of the industrial, commercial, and retail sources are located in urbanized areas. This premise may not hold true for activities that are usually located in rural areas, such as agricultural or silvicultural operations. However, because rural counties have a lower proportion of urbanized population, facilities that are commonly located in rural counties would be allocated to the non-urbanized portion of the county under this procedure. Thus, on average on a national scale,[20] the premise provides a useful estimation tool even for typically rural enterprises. This procedure is explained in more detail in Chapter 2.

The results of the distributional analysis of facilities and SIC-code activities are presented graphically in this section. Figure 4-1 shows the geographic distribution of facilities (by county) in the 90 selected four-digit SIC codes (potential Phase II) chosen for analysis. Counties are shaded in the map based on the number of facilities located in each. Counties with more than 1,000 facilities are shown in black, those with 500 to 999 facilities are shown in cross-hatch shading, and those with 250 to 499 facilities are shown in light shading. Counties with facility counts lower than 250 are shown in white but are not outlined.

Figure 4-2 shows similar information, except that counties are shaded on the basis of density of facilities (facilities per square mile) rather than straight facility counts. The

[20] The analysis does not address individual commercial and retail activities that are located in Territories other than the District of Columbus.

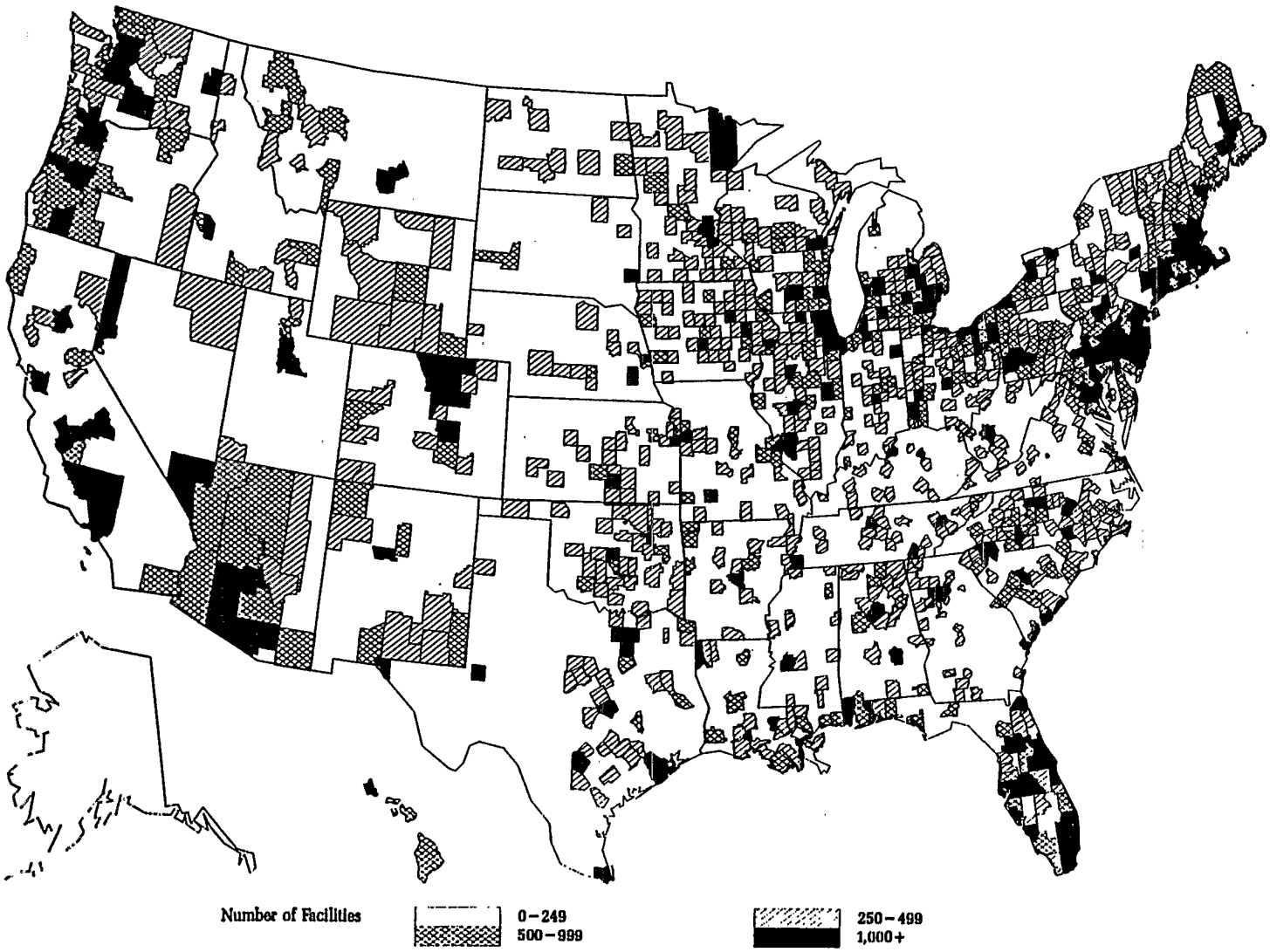

Figure 4-1. Geographic Distribution of Facilities With Selected 4-Digit SIC Codes (counties with less than 250 facilities are not shown)

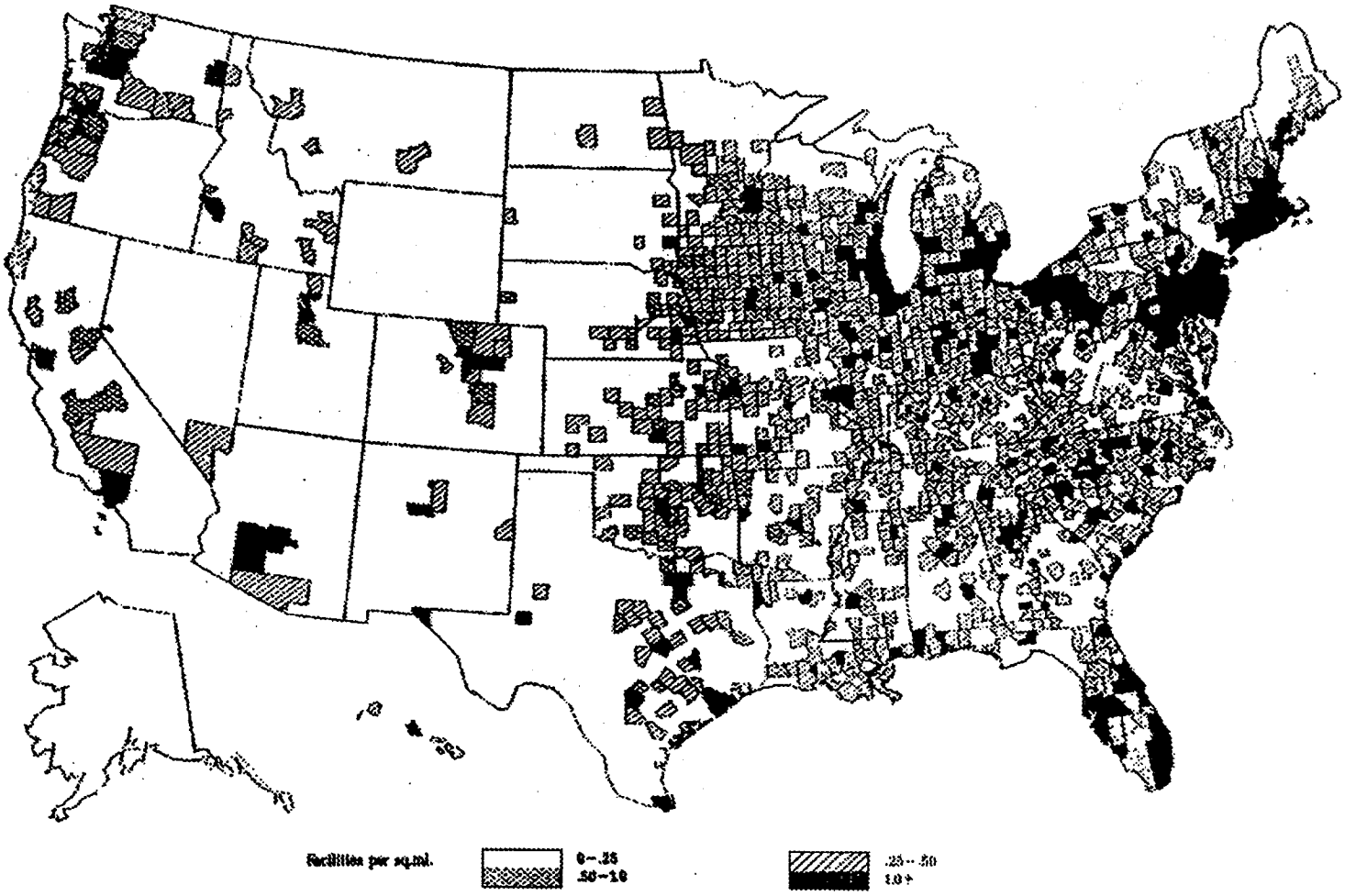

Figure 4-2. Geographic Distribution of Facilities With Selected 4-Digit SIC Codes by Density (counties with less than .25 facilities per square mile are not shown)

counties with the densest concentrations of facilities are shown in black, counties in the next density class are shown in cross-hatch shading, and the third density class is shown in light shading. Counties in the lowest density class are shown in white, but are not outlined.

As illustrated, the largest numbers and concentrations of facilities occur along the Eastern Seaboard; the industrialized southern Great Lakes Region; southern Florida; the Gulf Coast; and major cities of the southwest, California, and the Pacific Northwest. Although results for density show more focus around population centers, especially in the East and Midwest, both maps illustrate that potential Phase II facilities, which represent economic activity in industries, businesses, offices, and government services, are highly associated with population centers, in general. The same generalizations apply whether based on numbers of facilities or density of facilities, indicating that the most populous places tend also to have the greatest concentrations of potential Phase II facilities.

This geographic information on facility location is also presented quantitatively to lend additional insights. As described in the approach in Chapter 2, facility-specific information, including SIC code and county location, was combined with information from the 1990 census, which includes county population and area. These two sources of data were used to analyze the geographic distribution of all facilities in all two-digit SIC codes and of the 90 four-digit SIC codes selected as Group B Phase II categories. The results of this analysis are reported in detail in Appendix G. This section reviews some of the data and highlights important findings for the Group B sectors.

Table 4-9 presents information about the geographic distribution of industrial and commercial facilities in urbanized areas, based on the location with respect to Phase I cities. The columns of the table illustrate the locational relationships among jurisdictions when taking the perspective of expanding from current core (Phase I) cities out to the urbanized areas surrounding them, then on to remaining urbanized areas. Note that some urbanized areas encompass Phase I cities, while others are not contiguous with them.

Table 4-9. Geographic Distribution of Potential Phase II Facilities in Relation to Urbanized Areas

Potential Phase II Facilities Identified		Cumulative % of facilities located within:		
Description	Count	Phase I Areas	Phase I Areas + UAs	All UAs
Phase II - Group A	100,000[1]	32	45	61
Phase II - Group B	1,015,239	28	40	56
Group B Sectors				
Automotive Service	369,870	27	38	55
Machinery & Electrical Repair	135,744	29	40	56
Intensive Ag. Chemical Use	121,861	26	38	54
Wholesale, Machinery	77,562	32	47	65
Laundries	51,376	38	52	71
Wholesale, Wood Products	48,593	26	36	53
Livestock, Feedlots	43,421[2]	8	11	20
Petrol. Pipelines & Distributors	35,319	16	25	39
Photographic Activities	30,684	40	53	70
Various Utilities	22,242	24	36	53
Extensive Ag Chem Use	18,992	31	42	62
Transport, Rail and Other	14,808	47	64	81
Wholesale, Metal Products	14,303	36	54	75
Wholesale, Food	11,372	36	49	67
Laboratories	10,683	38	56	74
Munic. Services, Vehicle Maint	4,611	25	35	51
National Security	2,414	34	43	60
Wholesale, Coal & Ores	1,384	23	31	48

[1] This figure is an approximation based on the total number of facilities in SIC codes 10 through 45 after subtracting an estimate of the number of facilities covered under Phase I. Geographical distribution information is based on all facilities in SIC codes 10 through 45 and may not be representative of all classes of facilities in this group. For the geographic distribution of specific SIC codes, refer to Appendix G.

[2] This number is based on SIC codes and does not reflect all feedlots potentially subject to Phase II. The United States Department of Agriculture has estimated that there are approximately 378,000 animal feeding operations between 20 and 1,000 animal units. The facilities identified here should be representative of feedlots in general and allow estimation of the distribution of these facilities as a class.

The rows of the table show each potential Phase II sector and the proportion of industrial facilities located in each of the geographic jurisdictions. Other major groups of industries—all facilities nationally, agricultural and silvicultural categories, manufacturing categories, and all commercial and retail categories—are included in the table to show by comparison how the potential Phase II categories are distributed relative to other major

industrial and commercial sectors. As shown in the table, about one-third of the potential Phase II industrial and commercial facilities within the United States are located within municipalities already covered under Phase I of the storm water program. As a point of reference, agricultural and silvicultural activities (SIC Codes 01xx to 09xx) are less often associated with cities or urban areas. Only about 14 percent of the facilities in these agricultural sectors are associated with Phase I cities. Only about half of them are associated with urban areas, as compared to three-quarters for other more industrial sectors. This distribution holds also for the Phase II sector containing livestock and feedlot activities.

The table also shows the cumulative effect of expanding control of individual sources outward from central cities to encompass larger urbanized areas. In general, 30 percent of facilities are located in regulated Phase I municipalities, an additional 15 percent are located in the urbanized areas associated with Phase I cities, and an additional 15 percent are found in the remaining urbanized areas. Thus, about twice as many industrial facilities are found in all urbanized areas as are found in Phase I cities alone. This result holds for most of the potential Phase II categories. However, there are some exceptions. Petroleum pipelines and distributors show a weaker association with urban areas. It also is not surprising that feedlots are less closely associated with highly urbanized areas.

In another series of analyses, the distribution of industrial facilities was examined according to other geographic areas of potential interest. The results of these analyses are reviewed briefly here; Appendix F contains complete results. Urbanized areas of various population size classes were analyzed. This analysis shows that most facilities (about 45 to 50 percent) are located in the largest urbanized areas (over 250,000 people). An additional 7 percent are found in medium UAs (from 100,000 to 250,000 people). An additional 5 percent are found in UAs containing 50,000 to 100,000 people. These results show that the majority of facilities are located in the largest UAs and only a small increment is gained by including smaller UAs in the regulatory scenario.

For additional perspective on potential Phase II areas of concern, an analysis was conducted on the relationship between facility distribution and fast growing geographic areas. This analysis focused on counties expected to grow by more than 15 percent in the 15 years between 1990 and 2005 (based on Census Bureau projections).[21] The results show that about a quarter of Phase II facilities are located in these fast-growing counties. Of these, almost three-quarters are located in urbanized areas.[22]

Because coastal areas are also a potential concern, as reflected in the CZARA program, another analysis addressed the geographic distribution of industrial and commercial facilities in coastal counties. The definition used by the National Oceanic and Atmospheric Administration and the Bureau of the Census of the Department of Commerce is used in determining coastal counties. Of the 3,141 counties in the United States, 672 are defined as coastal by NOAA and have at least 15 percent of their land area in a coastal watershed or in a coastal cataloging unit (note that this is quite different from the "coastal zone" definition used in CZARA). The results reveal that coastal areas represent an important component of the industrial and commercial base in the country. As many as 44 percent of the potential Phase II facilities are located in coastal areas. Of these, about one-third are in areas that are already regulated in Phase I and almost three-quarters are located in urbanized areas.

The results in this section covered the 18 Group B sectors. The detailed results of this analysis for all two-digit and selected four-digit SIC codes are reported in Appendix G. The four-digit analysis provides a more detailed look at certain subsets within the two-digit groups. Generally, the four-digit breakdowns follow the pattern of the major (two-digit) groups: for the most part, the additional detail about selected four-digit SICs does not reveal much beyond that provided by the major group distribution.

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[21] Note that this designation of "growing counties" differs from that used in Chapter 3.

[22] While this result holds in general, petroleum pipelines, wholesale coal and ores, and livestock feedlots appear to be less closely associated with fast growing areas.

4.3 SUMMARY

This section summarizes the findings on individual sources in terms of the main elements identified by Congress for discussion in this report: identification, nature and extent of unregulated discharges. Due to very limited national data on which to base loadings estimates, the discussion of the extent of unregulated storm water discharges is limited to an analysis of the number and geographic distribution of potential Phase II facilities.

4.3.1 Identification of Phase II Sources

The effort to identify sources and categories of storm water discharges for which permits are not required in Phase I of the program resulted in the identification of two general classes of facilities. The first group includes sources that are very similar or identical to Phase I activities but that were omitted from Phase I for a variety of statutory and regulatory reasons (Group A). The second general class of facilities were identified on the basis of potential activities and pollutants that may contribute to storm water contamination (Group B). The report also discussed general sources of storm water contamination which are widespread and not necessarily associated with specific activities or facilities.

Although the difficulty in differentiating Group A facilities from existing Phase I regulated activities makes quantitative analysis difficult, EPA estimates that there are approximately 100,000 facilities in this group. Facilities in Group A, which may be of high priority for Phase II due to their similarity to Phase I industrial facilities, are described and categorized in this report but are not included in the subsequent geographical analysis in the same level of detail as Group B facilities. Activities identified in Group A can be classified into three distinct categories: auxiliary or secondary activities such as vehicle maintenance in support of an unregulated activity; facilities which are related to Phase I facilities but that were intentionally omitted such as POTWs with a capacity of less than 1 MGD; and facilities which were specifically exempted from Phase I by the Transportation Act which include industrial activities owned or operated by municipalities of less than 100,000 population.

Group B consists of over one million facilities in 90 SICs. These 90 SIC categories have been organized into 18 Phase II sectors for the purposes of this report. Of these 18 sectors, the automobile service sector (comprised of gas/service stations (SIC 5541), general automobile repair (SIC 7538), top, body repair (SIC 7532), repair shops and services (SIC 7699), car dealers, new & used (SIC 5511), car dealers, used only (SIC 5521), car washes (SIC 7542), passenger car rental (SIC 7514), truck rental (SIC 7513), parking structures (SIC 7521), and miscellaneous auto services (SIC 7549)), make up more than one-third of the total number of facilities identified in all 18 sectors.

Other general sources of storm water discharges discussed but not clearly identified in the report include parking lots, trash dumpsters, leaking and failing septic systems, and activities related to individual residences such as fertilizer and pesticide application. Facilities in the service sectors, such as banking, finance, insurance firms, and all types of food services, were also discussed but not included in much of the analysis.

4.3.2 Nature of Phase II Sources

There is little quantitative or comprehensive data from a national perspective on the concentrations and loadings of storm water discharges from the industrial, commercial, and retail facilities selected for study as potential Phase II sources. As a result, it is not currently possible to estimate national concentrations or loadings from these sources. It is clear, however, that a significant number of facilities remain in unregulated Phase II categories that conduct operations that have the potential to discharge contaminated storm water. It is possible to classify the unregulated categories into three major groups:

- All of the potential Phase II facilities in Group A may have discharges similar or identical to discharges associated with industrial activity regulated under Phase I.
- Of the facilities in Group B, 80 percent may have discharges similar or identical to discharges associated with industrial activity regulated under Phase I. Facilities in this class have activities analogous to Phase I activities but are covered by different SIC codes. These facilities are also likely to employ substances that could result in

pollutants, such as toxics, metals, solvents and oil and grease, entering storm water.[23] This class includes wholesale operations and vehicle repair and maintenance categories.

- Almost 20 percent of the facilities in Group B had activities that resemble exempted agricultural sources but do not fall under the statutory exclusion of agriculture. These include smaller, currently unregulated feedlots, nurseries, and retailers of farm supply chemicals. Facilities in this class are likely to have activities that result in contributions of pesticides or fertilizers and nutrients to storm water.

In general, industries with large areas of industrial activity and significant materials exposed to storm water exhibited the highest concentrations of pollutants in their storm water discharges. Suspended solids, which can also carry metals and organic pollutants, appear to be the pollutant with the highest concentrations overall. Chemical oxygen demand appears at relatively high concentration levels in some industrial sectors. Oil and grease results were highly variable but highest in industrial sectors associated with transportation and vehicle and machinery maintenance. Results for metals varied across industrial sectors, but those that handle, process, manufacture, or mine metals, as well as landfills, had higher concentrations than other categories. Biochemical oxygen demand, and nutrients (nitrogen and phosphorus) were generally not found at high concentration levels in Phase I data, although results were variable for nutrients.

4.3.3 Geographic Distribution

The geographical analysis shows that the majority of industrial and commercial facilities are located in or near population centers (cities and other urban places). To the extent that they are located in populous, urbanized areas, they are more likely to be served by municipal storm sewers (either separate or combined) than to be discharging directly to streams.

[23] About 2 percent of these facilities conduct other activities that may use toxic pollutants but are not substantially similar to the other facilities in this group. These include research laboratories and some kinds of municipal or governmental entities, which may engage in a wide variety of activities. There is very little information available about the pollution potential of facilities in this class.

In general, about 30 percent of potential Phase II facilities are found within the geographic jurisdiction of a Phase I municipality. An additional 20 to 30 percent of Phase II facilities fall into Census-designated urbanized areas. Thus, nearly twice as many industrial facilities are found in all urbanized areas as are found in Phase I municipalities alone.

Notable exceptions to these generalizations include lawn/garden establishments, feedlots, wholesale livestock, farm and garden machinery repair, bulk petroleum wholesale, farm supplies, lumber and building materials, and petroleum pipelines, which are (relatively) more frequently associated with smaller municipalities or rural areas. Because a larger portion of these facilities are outside the confines of regulated municipalities, a larger portion of storm water discharges from these facilities may be going directly to receiving waters rather than into municipal separate storm sewer systems.

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APPENDIX A

LIST OF PHASE I MUNICIPAL SEPARATE STORM SEWER SYSTEMS

List of Phase I Municipal Separate Storm Sewer Systems (Incorporated Places)

State	Place Name	Population	Area (sq.mi.)
Alaska	Anchorage city*	226,338	1697.65
Alabama	Adamsville city	4,161	3.07
	Alabaster city	14,732	18.85
	Bessemer city	33,497	38.70
	Birmingham city*	265,968	148.49
	Brighton city	4,518	1.40
	Brookside town	1,365	2.38
	Chickasaw city	6,649	3.58
	Creola city	1,896	14.60
	Daphne city	11,290	11.03
	Fairfield city	12,200	3.36
	Fairhope city	8,485	7.70
	Fultondale city	6,400	7.57
	Gardendale city	9,251	15.14
	Graysville city	2,241	2.79
	Helena city	3,918	13.73
	Homewood city	22,922	7.37
	Hoover city	39,788	23.85
	Hueytown city	15,280	8.65
	Huntsville city*	159,789	164.39
	Indian Springs	NA	NA
	Irondale city	9,454	8.83
	Leeds city	9,946	21.48
	Lipscomb city	2,892	1.15
	Madison city	14,904	20.01
	Maytown town	651	2.74
	Midfield city	5,559	2.45
	Mobile city*	196,278	118.03
	Montgomery city*	187,106	134.98
	Moody town	4,921	11.05
	Mountain Brook city	19,810	11.61
	Mulga town	261	0.19
	Pelham city	9,765	13.80
	Pleasant Grove city	8,458	6.17
	Prichard city	34,311	25.39
	Saraland city	11,751	11.40
	Satsuma city	5,194	5.97
	Tarrant city	8,046	6.36
	Trussville city	8,266	14.84
	Vestavia Hills city	19,749	8.83
Arkansas	Little Rock city*	175,795	102.86

NOTE: Unless indicated otherwise, municipalities have been designated.
* Identified in November 1990 rule.
† 1990 Census population increased to over 100,000 and municipality has been designated.
NA Not available

List of Phase I Municipal Separate Storm Sewer Systems (Incorporated Places) (continued)

State	Place Name	Population	Area (sq.mi.)
Arizona	Mesa city*	288,091	108.59
	Mesa city*	288,091	108.59
	Phoenix city*	983,403	419.91
	Tempe city*	141,865	39.52
	Tucson city*	405,390	156.29
California	Agoura Hills city	20,390	8.17
	Alameda city	76,459	10.75
	Albany city	16,327	1.70
	Alhambra city	82,106	7.62
	Anaheim city*	266,406	44.28
	Arcadia city	48,290	10.88
	Artesia city	15,464	1.62
	Atherton town	7,163	4.89
	Azusa city	41,333	9.00
	Bakersfield city*	174,820	91.84
	Baldwin Park city	69,330	6.60
	Bell city	42,355	2.51
	Bellflower city	34,365	2.56
	Bell Gardens city	61,815	6.08
	Belmont city	24,127	4.53
	Berkeley city*	102,724	10.46
	Beverly Hills city	31,971	5.68
	Big Bear Lake city	5,351	6.24
	Bradbury city	829	1.67
	Brisbane city	2,952	3.33
	Burbank city	93,643	17.35
	Burlingame city	26,801	4.35
	Camarillo city	52,303	18.44
	Campbell city	36,048	5.61
	Carlsbad city	63,126	37.67
	Carson city	83,995	18.84
	Cerritos city	53,240	8.61
	Chula Vista city†	135,163	28.99
	Claremont city	32,503	11.01
	Colma town	1,103	1.90
	Commerce city	12,135	6.53
	Compton city	90,454	10.17
	Concord city	111,348	29.47
	Contra Costa county (15 cities)	~553,831	~172.65
	Coronado city	26,540	7.71

NOTE: Unless indicated otherwise, municipalities have been designated.
* Identified in November 1990 rule
† 1990 Census population increased to over 100,000 and municipality has been designated.
NA Not available

List of Phase I Municipal Separate Storm Sewer Systems (Incorporated Places) (continued)

State	Place Name	Population	Area (sq.mi.)
California (continued)	Covina city	43,207	6.90
	Cudahy city	22,817	1.10
	Culver City city	38,793	5.10
	Cupertino city	40,263	10.30
	Daly City city	92,311	7.51
	Del Mar city	4,860	1.77
	Diamond Bar city	53,672	15.09
	Downey city	91,444	12.44
	Duarte city	20,688	7.21
	Dublin city	23,229	8.56
	East Palo Alto city	23,451	2.55
	El Cajon city	88,693	14.41
	El Monte city†	106,209	9.50
	El Segundo city	15,223	5.55
	Emeryville city	5,740	1.22
	Encinitas city	55,386	17.95
	Escondido city†	108,635	35.64
	Fairfield city	77,211	35.85
	Fillmore city	11,992	2.64
	Folsom city	29,802	21.43
	Foster City city	28,176	3.76
	Fremont city*	173,339	77.03
	Fresno city*	354,202	99.14
	Fullerton city*	114,144	22.12
	Galt city	8,889	5.60
	Gardena city	143,050	17.94
	Garden Grove city*	49,847	5.28
	Gilroy city	31,487	10.26
	Glendale city*	180,038	30.61
	Glendora city	47,828	19.47
	Half Moon Bay city	8,886	6.47
	Hawaiian Gardens city	13,639	0.95
	Hawthorne city	71,349	5.93
	Hayward city†	111,498	43.45
	Hermosa Beach city	18,219	1.43
	Hidden Hills city	1,729	1.62
	Hillsborough town	10,667	6.22
	Huntington Beach city*	181,519	26.42
	Huntington Park city	56,065	3.05
	Imperial Beach city	26,512	4.25
	Industry city	631	11.56
	Inglewood city†	109,602	9.17
	Irvine city†	110,330	42.32

NOTE: Unless indicated otherwise, municipalities have been designated.
* Identified in November 1990 rule.
† 1990 Census population increased to over 100,000 and municipality has been designated.
NA Not available

List of Phase I Municipal Separate Storm Sewer Systems (Incorporated Places) (continued)

State	Place Name	Population	Area (sq.mi.)
California (continued)	Irwindale city	1,050	9.32
	La Canada Flintridge city	19,378	8.67
	Laguna Beach city	23,170	8.68
	La Habra Heights city	6,226	6.37
	Lakewood city	73,557	9.39
	La Mesa city	52,931	9.22
	La Mirada city	40,452	7.85
	La Palma city	15,932	1.82
	La Puente city	36,955	3.49
	La Verne city	30,897	7.79
	Lawndale city	27,331	1.98
	Lemon Grove city	23,984	3.79
	Livermore city	56,741	19.63
	Lomita city	19,382	1.89
	Long Beach city*	429,433	50.02
	Los Alamitos city	11,676	4.03
	Los Altos city	7,514	8.42
	Los Altos Hills town	26,303	6.37
	Los Angeles city*	3,485,398	469.34
	Los Gatos town	27,357	10.38
	Lynwood city	61,945	4.86
	Manhattan Beach city	32,063	3.93
	Maywood city	27,850	1.17
	Menlo Park city	28,040	10.06
	Millbrae city	20,412	3.21
	Milpitas city	50,686	13.76
	Modesto city*	164,730	30.18
	Monrovia city	35,761	13.37
	Montebello city	3,287	1.61
	Monterey Park city	59,564	8.26
	Monte Sereno city	60,738	7.64
	Moorpark city	25,494	12.26
	Moreno Valley city†	118,779	49.13
	Mountain View city	67,460	12.03
	National City city	54,249	7.57
	Newark city	37,861	13.96
	Norwalk city	94,279	9.76
	Oakland city*	372,242	56.06
	Oceanside city†	128,398	40.67
	Ojai city	7,613	4.43
	Ontario city†	133,179	36.75
	Orange city†	110,658	23.34
	Orange county (17 cities)	~841,825	~179.74

NOTE: Unless indicated otherwise, municipalities have been designated.
* Identified in November 1990 rule
† 1990 Census population increased to over 100,000 and municipality has been designated.
NA Not available

List of Phase I Municipal Separate Storm Sewer Systems (Incorporated Places) (continued)

State	Place Name	Population	Area (sq.mi.)
California (continued)	Oxnard city*	142,216	24.44
	Pacifica city	37,670	12.64
	Palo Alto city	55,900	23.68
	Palos Verdes Estates city	13,512	4.81
	Paramount city	47,669	4.70
	Pasadena city*	131,591	22.99
	Pico Rivera city	59,177	7.98
	Piedmont city	10,602	1.68
	Pleasanton city	50,553	16.21
	Pomona city†	131,723	22.83
	Port Hueneme city	20,319	4.43
	Poway city	43,516	39.28
	Rancho Cucamonga city†	101,409	37.81
	Rancho Palos Verdes city	41,659	13.66
	Redondo Beach city	60,167	6.28
	Redwood City city	66,072	19.04
	Riverside city*	226,505	77.68
	Riverside county (10 cities)	~161,120	~133.44
	Rolling Hills city	7,789	3.54
	Rolling Hills Estates city	1,871	3.05
	Rosemead city	51,638	5.12
	Sacramento city*	369,365	96.29
	Salinas city†	108,777	18.63
	San Bernardino city*	164,164	55.08
	San Bernardino county (13 cities)	~558,047	~231.35
	San Bruno city	38,961	6.43
	San Carlos city	26,167	5.63
	San Diego city*	1,110,549	324.00
	San Dimas city	32,397	15.52
	San Fernando city	22,580	2.39
	San Gabriel city	37,120	4.14
	San Jose city*	782,248	171.26
	San Leandro city	68,223	13.11
	San Marcos city	38,974	23.19
	San Marino city	12,959	3.77
	San Mateo city	85,486	12.21
	Santa Ana city*	293,742	27.09
	Santa Clara	93,613	18.30
	Santa Clarita city†	110,642	40.48
	Santa Fe Springs city	15,520	8.67
	Santa Monica city	86,905	8.27
	Santa Paula city	25,062	4.60

NOTE: Unless indicated otherwise, municipalities have been designated.
* Identified in November 1990 rule.
† 1990 Census population increased to over 100,000 and municipality has been designated.
NA Not available

List of Phase I Municipal Separate Storm Sewer Systems (Incorporated Places) (continued)

State	Place Name	Population	Area (sq.mi.)
California (continued)	Santee city	52,902	15.87
	Saratoga city	28,061	11.97
	Seal Beach city	25,098	11.72
	Sierra Madre city	10,762	3.00
	Signal Hill city	8,371	2.22
	Simi Valley city†	100,217	33.03
	Solana Beach city	12,962	3.52
	South El Monte city	20,850	2.89
	South Gate city	86,284	7.35
	South Lake Tahoe city	21,585	10.06
	South Pasadena city	23,936	3.43
	South San Francisco city	54,312	8.96
	Stockton city*	210,943	52.57
	Suisun City city	22,686	3.56
	Sunnyvale city*	117,229	21.90
	Temple City city	31,100	4.01
	Thousand Oaks city†	104,352	49.56
	Torrance city*	133,107	20.52
	Union City city	53,762	18.76
	Vallejo city†	109,199	30.22
	Vernon city	152	4.93
	Vista city	71,872	17.94
	Walnut city	29,105	8.86
	West Covina city	96,086	16.20
	West Hollywood city	36,118	1.88
	Westlake Village city	7,455	5.21
	Whittier city	77,671	12.53
	Woodside town	5,035	11.74
Colorado	Aurora city*	222,103	132.53
	Colorado Springs city*	281,140	183.19
	Denver city*	467,610	153.28
	Lakewood city*	126,481	40.80
	Pueblo city	98,640	35.90
Connecticut	Stamford city*	108,056	37.72
District of Columbia	Washington city*	606,900	61.41
Delaware	Arden village	477	0.27
	Ardencroft village	282	0.11
	Ardentown village	325	0.17
	Bellefonte town	1,243	0.18
	Delaware City city	1,682	1.24
	Elsmere town	5,935	0.98
	Middletown town	3,834	3.41

NOTE: Unless indicated otherwise, municipalities have been designated.
* Identified in November 1990 rule.
† 1990 Census population increased to over 100,000 and municipality has been designated.
NA Not available

List of Phase I Municipal Separate Storm Sewer Systems (Incorporated Places) (continued)

State	Place Name	Population	Area (sq.mi.)
Delaware (continued)	Newark city	25,098	8.62
	New Castle city	4,837	2.22
	Newport town	1,240	0.37
	Odessa town	303	0.44
	Townsend town	322	0.21
	Wilmington city	71,529	10.78
Florida	Atlantis city	1,653	1.35
	Auburndale city	8,858	4.10
	Bartow city	14,716	8.59
	Belle Glade city	60	0.06
	Boca Raton city	61,492	27.19
	Boynton Beach city	46,194	15.14
	Briny Breezes town	400	0.07
	Broward County (24 cities)	1,050,742	322.96
	Century town	1,989	3.28
	Clearwater city	98,784	24.88
	Cloud Lake town	121	0.06
	Dade County (19 cities)	886,235	118.42
	Davenport city	1,529	1.47
	Delray Beach city	47,181	14.84
	Dundee town	2,335	3.10
	Eagle Lake city	1,758	0.72
	Fort Lauderdale city*	149,377	31.36
	Fort Meade city	4,976	3.17
	Frostproof city	2,808	2.39
	Glen Ridge town	207	0.23
	Golf village	234	0.83
	Golfview town	153	0.16
	Greenacres City city	18,683	4.05
	Gulf Stream town	11,727	2.84
	Haines City city	11,683	8.01
	Haverhill town	1,058	0.52
	Hialeah city*	188,004	19.24
	Highland Beach town	3,209	0.49
	Highland Park village	155	0.45
	Hillcrest Heights town	221	0.16
	Hollywood city*	121,697	27.26
	Homestead city	26,866	11.61
	Hypoluxo town	830	0.60
	Jacksonville city*	635,230	758.67
	Juno Beach town	2,121	1.08
	Jupiter town	405	0.18
	Jupiter Inlet Colony town	24,986	13.11

NOTE: Unless indicated otherwise, municipalities have been designated.
* Identified in November 1990 rule.
† 1990 Census population increased to over 100,000 and municipality has been designated.
NA Not available

List of Phase I Municipal Separate Storm Sewer Systems (Incorporated Places) (continued)

State	Place Name	Population	Area (sq.mi.)
Florida (continued)	Lake Alfred city	3,622	2.52
	Lake Clarke Shores town	3,364	0.98
	Lake Hamilton town	1,128	3.03
	Lakeland city	6,704	1.80
	Lake Park town	9,670	6.40
	Lake Wales city	28,564	5.62
	Lake Worth city	70,576	38.39
	Lantana town	8,392	2.28
	Longboat Key town	5,937	4.92
	Manalapan town	312	0.45
	Mangonia Park town	1,453	0.71
	Miami city*	358,548	35.57
	Miramar city	40,663	29.67
	Mulberry city	2,988	2.87
	North Palm Beach village	11,343	3.31
	North Port city	11,973	74.78
	Ocean Ridge town	1,570	0.86
	Orange County (8 cities)	239,522	103.68
	Orlando city*	164,693	67.27
	Pahokee city	6,822	5.34
	Palm Beach town	22,965	26.28
	Palm Beach Gardens city	1,040	0.25
	Palm Beach Shores town	9,814	3.93
	Palm Springs village	9,763	1.33
	Pembroke Pines city	65,452	31.94
	Pennsuee	NA	NA
	Pensacola city	58,165	22.64
	Pinellas County (21 cities)	586,612	NA
	Plant City city	66,692	21.75
	Polk City town	1,439	0.59
	Riviera Beach city	27,639	7.49
	Royal Palm Beach village	14,589	8.81
	St. Petersburg city*	238,629	59.19
	Sarasota city	50,961	14.62
	Seminole city	9,251	2.25
	South Bay city	3,558	1.93
	South Palm Beach town	1,480	0.13
	Tallahassee city†	124,773	63.27
	Tampa city*	280,015	108.67
	Temple Terrace city	16,444	4.94
	Tequesta village	4,499	1.71
	Venice city	16,922	7.42
	West Palm Beach city	67,643	49.33

NOTE: Unless indicated otherwise, municipalities have been designated.
* Identified in November 1990 rule.
† 1990 Census population increased to over 100,000 and municipality has been designated.
NA Not available

List of Phase I Municipal Separate Storm Sewer Systems (Incorporated Places) (continued)

State	Place Name	Population	Area (sq.mi.)
	Winter Haven city	24,725	12.19
Georgia	Acworth city	4,519	4.63
	Alpharetta city	13,002	19.02
	Atlanta city*	394,017	131.78
	Austell city	4,173	4.97
	Bloomingdale city	2,271	9.23
	Buford city	8,771	13.35
	Chamblee city	7,668	3.14
	Clarkston city	5,385	1.05
	College Park city	20,457	9.70
	Columbus city*	178,681	216.14
	Decatur city	17,336	4.16
	Doraville city	7,626	3.58
	Duluth city	9,029	7.39
	East Point city	34,402	13.76
	Fairburn city	4,013	4.46
	Forest Park city	16,925	8.59
	Garden City city	7,410	5.10
	Hapeville city	5,483	2.37
	Jonesboro city	3,635	2.40
	Kennesaw city	8,936	5.58
	Lawrenceville city	16,848	12.34
	Lilburn city	9,301	6.20
	Lithonia city	2,448	0.79
	Macon city*	106,612	47.88
	Marietta city	44,129	20.38
	Morrow city	5,168	2.83
	Norcross city	5,947	3.92
	Palmetto city	2,612	5.02
	Pooler city	4,453	11.07
	Powder Springs city	6,893	5.35
	Riverdale city	9,359	4.10
	Roswell city	47,923	32.57
	Savannah city*	137,560	62.59
	Smyrna city	30,981	11.37
	Snellville city	12,084	9.13
	Stone Mountain city	6,494	1.62
	Sugar Hill city	4,557	5.91
	Thunderbolt town	2,786	1.28
	Union City city	8,375	8.04
Iowa	Cedar Rapids city*	108,751	53.46
	Davenport city	95,333	61.36
	Des Moines city*	193,187	75.26
Idaho	Boise City city*	125,738	46.13
	Garden City city	6,369	3.33
Illinois	Rockford city*	139,426	44.98

NOTE: Unless indicated otherwise, municipalities have been designated.
* Identified in November 1990 rule.
† 1990 Census population increased to over 100,000 and municipality has been designated.
NA Not available

List of Phase I Municipal Separate Storm Sewer Systems (Incorporated Places) (continued)

State	Place Name	Population	Area (sq.mi.)
Indiana	Fort Wayne city*	173,072	62.66
	Indianapolis city*	731,327	361.67
Kansas	Kansas City city*	149,767	107.79
	Topeka city*	119,883	55.16
	Wichita city*	304,011	115.14
Kentucky	Lexington-Fayette*	225,366	284.52
	Louisville city*	269,063	62.11
Louisiana	Baton Rouge city*	219,531	73.95
	Gretna city	17,208	3.2
	Harahan city	9,927	1.98
	Kerner city	72,033	15.13
	New Orleans city*	496,938	180.65
	Shreveport city*	198,525	98.61
	Westwego city	11,218	3.19
Massachusetts	Boston city*	574,283	48.42
	Lowell city	103,439	13.78
	Worcester city*	169,759	37.56
Maryland	Baltimore city*	736,014	80.81
	Aberdeen	13,087	5.29
	Annapolis	33,187	6.33
	Bowie	8,860	2.57
	Bel Air	37,589	12.86
	Havre de Grace	8,952	3.31
	Takoma Park city	16,700	2.01
Michigan	Ann Arbor city*	109,592	25.90
	Flint city*	140,761	33.83
	Grand Rapids city*	189,126	44.26
	Sterling Heights city*	117,810	36.64
	Warren city*	144,864	34.28
Minnesota	Minneapolis city*	368,383	54.93
	St. Paul city*	272,235	52.79
Missouri	Independence city*	112,301	78.19
	Kansas City city*	435,146	311.53
	Springfield city*	140,494	67.95
Mississippi	Jackson city*	196,637	109.01
Nebraska	Lincoln city*	191,972	63.29
	Omaha city*	335,795	100.65
New Mexico	Albuquerque city*	384,736	132.20
Nevada	Henderson city	64,942	71.54
	Las Vegas city*	258,295	83.29
	North Las Vegas city	47,707	60.97
	Reno city*	133,850	57.50
	Sparks city	53,367	14.25

NOTE: Unless indicated otherwise, municipalities have been designated.
* Identified in November 1990 rule
† 1990 Census population increased to over 100,000 and municipality has been designated.
NA Not available

List of Phase I Municipal Separate Storm Sewer Systems (Incorporated Places) (continued)

State	Place Name	Population	Area (sq.mi.)
New York	New York city* (Bronx Borough) (Brooklyn Borough) (Manhattan Borough) (Queens Borough) (Staten Island Borough)	7,322,564	308.95
North Carolina	Charlotte city*	395,934	174.26
	Durham city*	136,611	69.27
	Fayetteville city	75,695	40.60
	Greensboro city*	183,521	79.79
	Raleigh city*	207,951	88.13
	Winston-Salem city*	143,485	71.12
Ohio	Akron city*	223,019	62.19
	Cincinnati city*	364,040	77.22
	Cleveland city*	505,616	77.02
	Columbus city*	632,910	190.92
	Dayton city*	182,044	55.00
	Toledo city*	332,943	80.57
Oklahoma	Oklahoma City city*	444,719	608.16
	Tulsa city*	367,302	183.52
Oregon	Banks city	563	0.33
	Barlow city	118	0.06
	Beaverton city	53,310	13.82
	Cornelius city	6,148	1.79
	Durham city	748	0.43
	Eugene city*	112,669	38.04
	Fairview city	2,391	3.16
	Forest Grove city	13,559	40.22
	Gaston city	563	2.45
	Gladstone city	10,152	22.06
	Gresham city	68,235	2.30
	Happy Valley city	1,519	19.26
	Hillsboro city	37,520	0.06
	Johnson City city	586	0.41
	King City city	2,060	9.54
	Lake Oswego city	30,576	4.76
	Milwaukee city	18,692	1.63
	North Plains city	972	4.69
	Portland city*	437,319	0.18
	Rivergrove city	294	.13
	Sherwood city	3,093	3.21
	Tigard city	29,344	10.19
	Tualatin city	15,013	7.10
	West Linn city	16,367	6.63
	Wilsonville city	7,106	6.39
Pennsylvania	Allentown city*	105,090	17.71
	Philadelphia city*	1,585,577	135.13

NOTE: Unless indicated otherwise, municipalities have been designated.
* Identified in November 1990 rule.
† 1990 Census population increased to over 100,000 and municipality has been designated.
NA Not available

List of Phase I Municipal Separate Storm Sewer Systems (Incorporated Places) (continued)

State	Place Name	Population	Area (sq.mi.)
South Dakota	Sioux Falls city	100,814	45.05
Tennessee	Belle Meade city	2,839	3.14
	Berry Hill city	802	0.90
	Chattanooga city*	152,466	118.43
	Forest Hills city	4,231	9.28
	Goodlettsville city	11,219	13.65
	Knoxville city*	165,121	77.25
	Lakewood city	2,009	0.96
	Memphis city*	610,337	256.04
	Nashville-Davidson city*	488,374	473.33
	Oak Hill city*	4,301	7.88
	Ridgetop town	1,132	1.49
Texas	Abilene city†	106,654	103.09
	Amarillo city*	157,615	87.93
	Arlington city*	261,721	93.00
	Austin city*	465,622	217.78
	Beaumont city*	114,323	80.06
	Corpus Christi city*	257,453	134.97
	Dallas city*	1,006,877	342.41
	El Paso city*	515,342	245.36
	Fort Worth city*	447,619	281.08
	Garland city*	180,650	57.35
	Houston city*	1,630,553	539.88
	Irving city*	155,037	67.62
	Laredo city†	122,899	32.87
	Lubbock city*	186,206	104.11
	Mesquite city†	101,484	42.84
	Pasadena city*	119,363	43.77
	Plano city†	128,713	66.25
	San Antonio city*	935,933	333.03
	Waco city*	103,590	75.79
Utah	Salt Lake City city*	159,936	109.02
Virginia	Chesapeake city*	151,976	340.68
	Hampton city*	133,793	51.82
	Newport News city*	170,045	68.34
	Norfolk city*	261,229	53.76
	Portsmouth city*	103,907	33.14
	Roanoke city	96,397	42.90
	Virginia Beach city*	393,069	248.32
Washington	Seattle city*	516,259	83.89
	Tacoma city*	176,664	48.05
Wisconsin	Madison city*	191,262	57.76
	Milwaukee city*	628,088	96.08

NOTE: Unless indicated otherwise, municipalities have been designated.
* Identified in November 1990 rule
† 1990 Census population increased to over 100,000 and municipality has been designated.
NA Not available

List of Phase I Municipal Separate Sewer Systems (Counties)

State	County	Unincorporated/ Urbanized Population	Total Population
Alabama	Baldwin county[1]	0	98,380
	Jefferson county[1]	78,608	651,525
	Mobile county[2]	45,418	378,643
	Shelby county[3]	16,148	99,358
	St. Clair county[4]	0	50,009
Arizona	Pima County*	162,202	666,880
California	Alameda County*	115,082	1,279,182
	Contra Costa County*	131,815	803,732
	Kern County*	128,504	543,447
	El Dorado County	0	125,995
	Fresno County	48,863	667,490
	Los Angeles County*	886,780	8,863,164
	Orange County*	223,081	2,410,556
	Placer County	10,564	172,796
	Riverside County*	166,509	1,170,413
	Sacramento County	594,889	1,041,219
	San Bernardino County*	162,202	1,418,380
	San Diego County*	250,414	2,498,016
	San Mateo County	50,250	649,623
	Santa Clara County	75,464	1,497,577
	Ventura County	41,020	669,016
Colorado	Arapahoe County†	103,248	391,511
Delaware	New Castle County*	296,996	441,946
Florida	Broward County*	142,329	1,255,488
	Dade County*	1,014,504	1,937,094
	Escambia County*	167,463	262,798
	Hillsborough County*	398,593	834,054
	Lee County†	102,337	335,113
	Manatee County†	123,828	211,707
	Orange County*	378,611	677,491
	Palm Beach County*	360,553	863,518
	Pasco County†	148,907	281,131
	Pinellas County*	255,772	851,659
	Polk County*	121,528	405,382
	Sarasota County*	172,600	277,776
	Seminole County†	127,873	287,529

[1] County was listed in regulation; however, population dropped below 100,000 in 1990 census.

[2] Unincorporated areas defined as: beginning at the mouth of the South Fork Deer River and extending west to SW corner Section 18, Township 6 South, Range 2 West, thence north to NW corner, Section 6, Township 2 South, Range 2 West, thence east to the Mobile County line, thence south along the county line to U.S. Highway 90 bridge.

[3] All unincorporated areas of Shelby County within the drainage basin of the Cahaba River upstream of the confluence of Shoal Creek and the Cahaba River.

[4] Unincorporated areas of St. Clair County within the drainage basin of the Cahaba River.

*Identified in November 1990 rule

†1990 Census unincorporated, urbanized population increased to more than 100,000 and municipality has been designated.

List of Phase I Municipal Separate Sewer Systems (Counties) (continued)

State	County	Unincorporated/ Urbanized Population	Total Population
Georgia	Bibb County	19,340	149,976
	Chatham County	40,649	216,935
	Clayton County*	133,237	182,052
	Cobb County*	322,595	447,745
	DeKalb County*	448,686	545,837
	Fulton County†	127,776	648,951
	Gwinnett County†	237,305	352,910
	Muscogee County	0	179,278
	Richmond County*	126,476	189,719
Hawaii	Honolulu County*	114,506	836,231
Kentucky	Jefferson County*	239,430	664,937
Louisiana	East Baton Rouge Parish†	102,539	380,105
	Jefferson Parish*	331,307	448,306
Maryland	Anne Arundel County*	344,654	427,239
	Baltimore County*	627,593	692,134
	Carroll County	0	123,372
	Charles County	0	101,154
	Frederick County	14,100	150,208
	Harford County	82,302	182,132
	Howard County†	157,972	187,328
	Montgomery County*	599,028	757,027
	Prince George's County*	494,369	729,268
	Washington County	28,321	121,393
North Carolina	Cumberland County*	146,827	274,566
Nevada	Clark County*	327,618	741,459
	Washoe County	26,530	254,667
Oregon	Clackamas County	65,088	278,850
	Multnomah County	52,923	583,887
	Washington County*	116,687	311,554
South Carolina	Greenville County*	147,464	320,167
	Richland County*	130,589	285,720
Texas	Harris County*	729,206	2,818,199
Utah	Salt Lake County*	270,989	725,956
Virginia	Arlington County*	170,936	170,936
	Chesterfield County*	174,488	209,274
	Fairfax County*	760,730	818,584
	Henrico County*	201,367	217,881
	Prince William County†	157,131	215,686
Washington	King County*	520,468	1,507,319
	Pierce County*	258,530	586,203
	Snohomish County*	157,218	465,642

*Identified in November 1990 rule

†1990 Census unincorporated, urbanized population increased to more than 100,000 and municipality has been designated.

List of Municipal Separate Storm Sewer Systems (Boundaries Not Defined by Census)

State	Municipal Separate Storm Sewer System
Alaska	DOT[1] University of Alaska Port of Anchorage
Alabama	Highway Department
Arizona	DOT
California	Alameda County Flood Control District Zone 7 of the Alameda County Flood Control District DOT Calabases Flood Control District Coachella Valley Area Contra Costa County Flood Control District Fresno Metro Flood Control District Malibu Flood Control District Orange County Flood Control District Riverside Flood Control District San Bernardino Flood Control District San Diego Unified Port District Santa Clara Valley Water District
Colorado	DOT Highway Department
Delaware	DOT
Florida	DOT Reedy Creek Improvement District
Hawaii	DOT
Idaho	DOT
Illinois	DOT
Indiana	DOT
Kansas	Kaw Valley Drainage District
Louisiana	DOT Louisiana State University Southern University
Maryland	State Highway Administration
Michigan	University of Michigan DOT
Minnesota	DOT Herrepin County Public Works Minneapolis Parks and Recreation University of Minnesota
North Carolina	DOT
Nevada	Clark County Flood Control District DOT
New Mexico	Albuquerque Metropolitan Flood Control Authority DOT
Ohio	DOT

[1] Department of Transportation

List of Municipal Separate Storm Sewer Systems (Boundaries Not Defined by Census) (continued)

State	Municipal Separate Storm Sewer System
Oklahoma	DOT Turpike Authority
Oregon	DOT Port of Portland Multhomah County Drainage Districts (3)
Pennsylvania	DOT
South Carolina	Harbor of Charleston
Tennessee	DOT
Texas	Harris County Flood Control District DOT University of Texas-Arlington University of Texas-Austin
Utah	DOT
Washington	DOT
Wisconsin	DOT University of Wisconsin

APPENDIX B

OVERVIEW OF IMPACTS FROM STORM WATER DISCHARGES

APPENDIX B - OVERVIEW OF IMPACTS FROM STORM WATER DISCHARGES

This appendix provides an overview of the types of impacts that storm water discharges have on receiving waters. Section B.1 describes the role of storm water discharges and the physical nature of storm water discharges. Section B.2 discusses the types of adverse impacts on receiving waters caused by storm water discharges. Section B.3 gives a general description of adverse impacts on various types of receiving waters that may be associated with storm water discharges.

B.1 THE PHYSICAL NATURE OF STORM WATER DISCHARGES

B.1.1 The Hydrologic Cycle

The hydrologic cycle is the continuous, unsteady circulation of water from the atmosphere to the Earth's surface and back to the atmosphere. Major features of the hydrologic cycle include precipitation, snow melt, surface runoff and drainage, infiltration, interflow, ground water recharge, and evapotranspiration. Each of these factors is discussed briefly below:

- **Precipitation**—Precipitation occurs as rain, sleet, hail, and snow. Precipitation is one of the key factors in analyzing storm water discharges because it is the initiating force in creating a discharge. Precipitation events are highly variable in nature and extent. As discussed in more detail below, the nature of precipitation patterns varies greatly in different parts of the country. Seasonal patterns also are usually important considerations.

- **Snow Melt**—When precipitation falls in the form of snow, surface runoff does not occur until the snow melts. In this case, the rate and volume of surface runoff discharges is controlled by the rate of snow melt.

- **Infiltration**—Infiltration occurs as rain water passes into the soil. The ability of soil to infiltrate water depends on a number of factors, including soil properties, soil

moisture content, vegetation cover, and the presence of impervious structures, such as pavement. Water that infiltrates into the soil can be subject to interflow, ground water recharge, and evapotranspiration.

- **Interflow**—Interflow (i.e., subsurface flow) occurs when water infiltrates into the soil and flows through the soil above the water table. Interflow can occur until water enters a drainage ditch, storm sewer, surface receiving water, or the ground water.

- **Ground Water Recharge**—Ground water recharge occurs when water infiltrates into the soil and enters the water table. Ground water then flows toward and into natural or artificial channels or other receiving waters. The flow of ground water to surface waters maintains flows in natural and manmade drainage ways and impoundments during dry weather conditions.

- **Evapotranspiration**—The term evapotranspiration describes two processes—evaporation and transpiration. Evaporation is the process where liquid water changes to a vapor. Transpiration occurs when water moves through vegetation and is then evaporated.

- **Surface Runoff and Natural Drainage**—Surface runoff (i.e., overland flow) occurs when water generated from precipitation or snow melt moves across the ground to a natural or constructed channel or some other receiving water. Natural drainage defines the flow of water through naturally occurring receiving waters and into the ocean. Because the natural drainage system contains a wide range of receiving waters, including wetlands and intermittent streams, it is often difficult to determine the point at which surface runoff ends and natural drainage begins. Although such distinctions may be important in our legal system, they have limited importance in the workings of the hydrologic cycle.

B.1.2 Impacts of Land Use Activities on the Hydrology of Watersheds

Typically, a watershed is a geographic region in which surface waters flow towards a common receiving point such as a stream, river, lake, or estuary. The natural drainage system of a watershed may comprise many types of surface water features, including wetlands, intermittent streams, small perennial streams, and larger receiving waters. In other uses of the term, watersheds may also be defined based on ground water flows and aquifers.

As watersheds are developed for urban or agricultural uses, resource extraction, or other purposes, the natural drainage features of the water are often altered. Wetlands are dredged or filled, reducing the natural storage capacity of the drainage system, which, prior to its loss, damped peak flows associated with storm events. Smaller streams can be channelized, rip-rapped, or diverted into underground culverts, all of which allow the flow rates in the channel to increase.

The hydrology of the watershed also is changed by activities occurring on land. The natural drainage features of undeveloped land slow the flow of runoff by incorporating rainfall into the natural hydrologic cycle. Many types of development cause an increase in the volume of surface runoff and its rate of discharge. A given storm event will yield more runoff with a faster rate of discharge for a developed area than for an undeveloped area of the same size. These increases in the rate of flow and the total volume of flow often have a decided effect on pollutant loads, erosion rates, and flooding.

A number of factors can increase the volume and rate at which runoff flows from a developed site. Clearing land removes the vegetation cover that previously intercepted precipitation before it hit the earth. The thick humus layer associated with the vegetative cover is often removed or eroded away during grading activities, decreasing the ability of the surface to infiltrate and retain precipitation. The land is graded to make the surface smoother by removing natural depressions. Site slopes may be increased as part of terracing to improve site drainage. Wetlands, which may have previously soaked up water associated with peak flows, are drained or filled. Impervious structures, such as roads, parking lots, driveways,

rooftops and sidewalks, are built. In other heavily used areas, soils become compacted and lose their ability to infiltrate precipitation.

After development has occurred, the natural drainage system (e.g., streams, wetlands, and other receiving waters) is often unable to handle the higher volume flows, resulting in high erosion rates or flooding. Drainage systems that have undergone these changes often need additional "improvement" from channelization or lining projects. In addition, streams are often directed through underground culverts.

The same characteristics of land development that cause higher peak flows also cause less infiltration of rainfall to recharge ground water supplies and a lowering of the water table. One result of lowered water tables is that surface stream flows during dry weather can be lowered significantly. Lower flows during periods between storms may significantly affect the aquatic habitat and the ability of a stream to dilute toxic spills or other dry weather pollutants within the stream system (Bellevue NURP). In some cases, the installation of storm sewers in a watershed results in small, previously perennial, streams running dry several times a year (Long Island NURP).

B.1.3 General Physical Characteristics of Storm Water Discharges

Storm water discharges are diffuse in nature; discharges in a watershed are generated by an extremely large number of points. Three characteristics of storm water discharges are particularly important when analyzing potential impacts of these diffuse sources within a watershed. Storm water discharges 1) may affect broad portions of a watershed, 2) can have high volumes, and 3) are generally of limited duration.

B.1.3.1 Effects on Broad Portions of a Watershed

Unlike many other major point source discharges that are directed to larger receiving water bodies or to relatively remote offshore locations, storm sewers discharge to essentially all of the portions of the drainage system within developed areas of the watershed. As a

result, the impacts of storm water discharges, although more subtle, may be more widespread and potentially may affect a greater degree of the natural drainage system than traditional point source discharges.

Perhaps the widespread nature of storm water discharges is most evident when considering large urbanized areas.[1] Essentially all receiving waters in urbanized areas receive storm water discharges from some type of urban land, regardless of the sensitivity of the receiving water to potential impacts. This is because typical storm water management practices attempt to drain water from the land as soon as possible and discharge it to the nearest receiving water whether or not the receiving water has the ability to handle increased flows and pollutant loads.

In heavily developed areas, urbanization results in widespread alteration or destruction of much of the natural drainage system. Many of wetlands in these areas are drained or filled, while smaller streams can be heavily modified. These alterations to the natural drainage system decrease the system's ability to remove pollutants, function as habitat, and handle large flows. The cumulative impacts of these widespread effects can potentially affect larger downstream components of the watershed.

B.1.3.2 High Volumes/Velocities

A typical storm may generate a large number of storm water discharges within a watershed. The cumulative volume of these discharges may be high relative to the typical volume of flow of receiving waters. These high volume discharges may dramatically increase flow velocities in streams and drainage channels. High volume storm water discharges and resultant rapid stream velocities cause the combined effect of increasing:

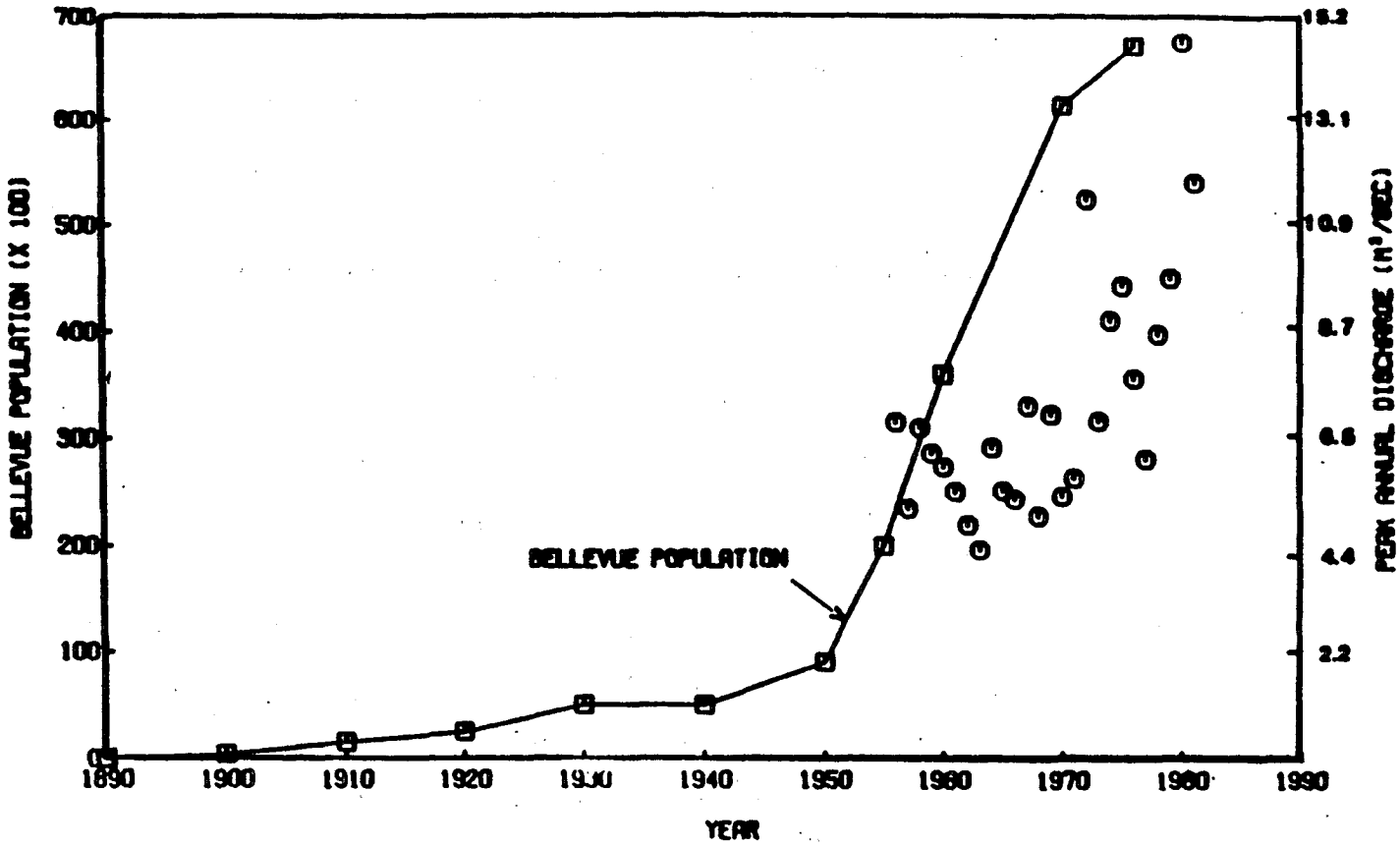
[1] As discussed in more detail in Chapter 3, the 366 urbanized areas designated by the Bureau of Census range in area from 17 square miles (Grand Forks, ND-MN) to more that 2,800 square miles (New York, NY-NJ).

- Pollutant loads
- The ability of discharges to erode the land and carry pollutants off the land
- The ability of streams to resuspend pollutants in bottom sediments and erode stream beds and stream banks
- The ability of streams to carry pollutants to slower flowing water bodies where pollutants may accumulate
- The need for stream channelization, installation of concrete walls, riprap, or other modification projects.

Figure B-1 shows the relationship between population and the volume of the peak annual flow in the Bellevue, Washington, watershed. The volume of the peak annual flow in the watershed almost doubled as the population in the city increased from 10,000 to 67,000. Peak flows that used to return every 10 years can now be expected to return at least every other year. Although the monthly average total volume of flows in the watershed increased only slightly over pre-urbanization years, the volume of flows during peak events increased two to three times as a result of urbanization. This increase in the volume of the peak annual watershed flow volumes increased stream bank erosion and stream bed scour, as well as the frequency of flooding. The increase in intensity of runoff has created unstable stream banks, which have eroded at a rapid rate. The stream channel is narrower and deeper than those of typical undisturbed streams serving similar watersheds. Pools and other sites along the stream bed that had slowed flows in the past have been removed by the higher flows.

B.1.3.3 Limited Duration

Although storm events and the resulting storm water discharges are of limited duration, pollutants in these discharges can cause both short- and long-term impacts on receiving waters. Short-term impacts generally occur during or shortly after a storm event. These impacts are usually caused by high levels of pollutants associated with the storm water discharges. Materials other than storm water, such as spills or dumped material, that discharge from a separate storm sewer may also cause short-term water quality impacts.



Source: Scott, Steward, and Stober

Figure B-1. Population of Bellevue and Peak Annual Discharge in Kelsey Creek (O). Data From U.S.G.S. and Bellevue Planning Dept. 1977

Long-term water quality impacts associated with storm water may be caused by pollutants accumulating in a watershed or by repeated exposures to pollutants from a large number of events. In addition, habitat destruction and other physical impacts, such as stream bed scour, can occur over a long period of time.

Although individual storm events are of relatively short duration, receiving waters may be affected by storm water discharges for time periods that are significantly longer than the storm event. The length of time that pollutants from storm water discharges remain in a receiving water will depend on four factors: 1) the duration of the storm event, 2) the size of the watershed, 3) flow rates in the receiving water, and 4) the tendency for pollutants to accumulate in bottom sediments.

Small streams with small drainage basins respond immediately to the pollutants in storm water discharges, with pollutants passing through at relatively high velocities as a discrete pulse. High pollutant levels in large flowing rivers may occur at downstream locations for an extended period of time. Pollutant concentrations in large rivers initially rise with the onset of a storm event. After a storm is over, pollutants from storm water discharges to feeder streams draining upstream portions of a watershed can keep pollutant levels elevated at downstream locations of the river for an extended period of time. Pollutants in storm water discharges from upstream land uses may continue to impact a location for several days after the event.

Receiving waters with slower flows and longer resident times, such as impoundments, lakes, reservoirs and estuaries, may be affected for long time periods by pollutants from short-duration storms. Hence, the limited duration of individual storm water discharge events is of less importance when considering potential impacts on these receiving waters. In these receiving waters, slower velocities will result in many types of pollutants accumulating in bottom sediments where they may cause long-term impacts.

B.2 TYPES OF ADVERSE IMPACTS ASSOCIATED WITH STORM WATER DISCHARGES

Table B-1 summarizes the pollutant classes and pollutant sources identified in the 1992 National Water Quality Inventory as major causes of water quality impairment. The National Water Quality Inventory summarizes information regarding water quality impacts that is submitted by States in Section 305(b) reports. The summary generally identifies conventional pollutants, such as nutrients, sediment (siltation), oxygen demand, and pathogens, as the leading causes of surface water impairment reported by the States. Toxicity, caused by metals, priority organics, pesticides, oil and grease, and inorganic pollutants, is also identified as a major cause of impairment.

Table B-1. Top Five Pollution Sources and Contaminants

Five Leading Sources of Water Quality Impairment			
Rank	**Rivers**	**Lakes**	**Estuaries**
1	Agriculture	Agriculture	Municipal Point Sources
2	Municipal Point Sources	Urban Runoff/Storm Sewers	Urban Runoff/Storm Sewers
3	Urban Runoff/Storm Sewers	Hydrologic/Habitat Modification	Agriculture
4	Resource Extraction	Municipal Point Sources	Industrial Point Sources
5	Industrial Point Sources	Onsite Wastewater Disposal	Resource Extraction
Five Leading Causes of Water Quality Impairment			
Rank	**Rivers**	**Lakes**	**Estuaries**
1	Siltation	Metals	Nutrients
2	Nutrients	Nutrients	Pathogens
3	Pathogens	Organic Enrichment/Low DO	Organic Enrichment/Low DO
4	Pesticides	Siltation	Siltation
5	Organic Enrichment/Low DO	Priority Organic Chemicals	Suspended Solids

Source: National Water Quality Inventory, 1992 Report to Congress, EPA, 1994.

The National Water Quality Inventory primarily addresses larger receiving water bodies and does not address major portions of the natural drainage system of most watersheds, such as smaller feeder streams and wetlands.

This section briefly describes the major classes of pollutants associated with water quality impacts. For each class, special considerations regarding storm water discharges are discussed. Three additional pollutant classes, acidity, temperature, and floatables, that are of special concern when addressing storm water discharges are also discussed.

B.2.1 Siltation/Sedimentation

Siltation from sediment pollutant loads can cause a broad range of interrelated impacts in receiving waters, including the following:

- **Loss of Benthic Habitat**—Increased stream flows and velocities produced by high volume storm water discharges may cause channel scour and bank erosion that result in habitat destruction. Suspended solids are deposited as sediment bars or sediment blankets in pools and other areas of reduced stream energy. These blankets can smother benthic organisms, including the eggs and immature forms of free-swimming organisms (Gupta, 1981; Novotny and Chesters, 1981).

- **Reduced Water Storage Capacity**—Increased sediment loads reduce water storage capacity in reservoirs (Novotny and Chesters, 1981). Nationwide, the average annual depletion rate of reservoir storage capacity caused by sedimentation is estimated at 0.2 percent (Tourbier, 1981). Sediment loads also decrease the depths of streams, which decreases the retention and conveyance capacity of streams and may result in increased flooding.

- **Impaired Oxygen Exchange**—Increased turbidity levels impair the ability of aquatic organisms to obtain dissolved oxygen from the water by interfering with the gill movements and associated water circulation (Novotny and Chesters, 1981).

- **Decreased Light Penetration**—The depth of light penetration into surface waters is sharply diminished by turbidity. As a result, photosynthetic activity and food sources are reduced. Loss of submerged aquatic vegetation may also remove habitat for juvenile fish and shellfish.

- **Impaired Navigation**—Accumulated sediments in river channels limit the passage of deeper draft boats, preventing navigational access or increasing the frequency of required channel maintenance dredging (Gupta et al., 1981; Novotny and Chesters,

1981). In some locations, sediments are so contaminated with pollutants that they should be handled as hazardous wastes, which dramatically increases disposal costs. Dredging activities result in re-suspension of pollutants in the sediment, causing additional water quality and aquatic habitat impacts (Novotny and Chesters, 1981).

- **Increased Water Treatment Costs**—Sediments can increase the costs of treating potable water supplies. Inadequate sediment removal may limit the germ-killing effects of chlorination.

- **Accumulation of Pollutants**—Many of the pollutants associated with many types of storm water discharges become chemically or physically bound with sediment particles. As these particles settle, the attached pollutants also sink (Brown et al., 1985; Novotny and Chesters, 1981). Sediments with attached pollutants can act as a source of contamination to the overlying water, to the benthic biota, and to the food chain. Over long periods of time, sediments may accumulate such high levels of toxics and other pollutants that exceedances of ambient water quality standards may occur in the water columns, increasing exposure of organisms to toxic chemicals (Harrington, 1986). Oxygen demanding pollutants in sediment deposits may also create oxygen deficits during and after storm water discharge events (Heaney and Huber, 1984; Mancini and Plummer, 1986; Novotny and Chesters, 1981).

- **Resuspension of Pollutants**—Highly variable flows in receiving waters can resuspend sediments, thereby increasing water column concentrations of those pollutants that had accumulated in bottom sediments. The repetitive process of deposition, re-suspension, and re-deposition of sediments may result in pollutants associated with sediments taking a long time to pass through a receiving stream (Novotny and Chesters, 1981).

B.2.2 Nutrients

Nutrients support and stimulate aquatic plant life. Natural nutrient cycles may be altered by land use activities within a watershed. Excessive nutrients overstimulate the growth of

aquatic plants, which may result in low oxygen levels, accelerate eutrophication, cause unsightly conditions, interfere with navigation, interfere with treatment processes, and cause unpleasant and disagreeable tastes and odors. Eutrophic conditions are evidenced by surface algal scums, reduced water clarity, odors, and dense algal growth on shallow water substrates (Schueler, 1987). Algal blooms block light from submerged aquatic vegetation, which may remove habitat for juvenile fish and shellfish. After blooms or at the end of a growing season, the decomposition of dead vegetation may cause reduced oxygen levels. Reduced oxygen levels may, in turn, cause fish kills and mass mortality of benthic organisms.

Excessive nutrients may have more adverse effects in surface water bodies that have slow flushing rates, such as slow moving rivers, lakes, and estuaries. Nutrients delivered during storm events settle to sediments of such waters. Once in sediments, the nutrients can be solubilized or re-suspended by anaerobic conditions, currents, changes in concentration gradients, or the mixing effects of boat wakes (Field and Turkeltaub, 1981).

Aquatic vegetation requires both nitrogen and phosphorus to grow. Excess quantities of nitrogen are commonly present in fresh water, so plant growth is usually controlled by the levels of phosphorus input (Schueler, 1987). In marine waters, however, phosphorus is often in greater supply, and plant growth is controlled by nitrogen concentrations. In either case, when the controlling nutrient is added, greater plant growth is expected.

Several forms of phosphorus occur in the aquatic environment. Major forms of phosphorus include orthophosphorus (OP), dissolved or soluble phosphorus (DP), particulate phosphorus (PP), and total phosphorus. Orthophosphorus is the form immediately available for algal growth. Particulate phosphorus is considered to be potentially available after conversion to OP. During stream transport, OP is likely to become incorporated into the particulate fraction. A portion of the phosphorus bound to sediment particles can also be released as OP. Exchange between available and potentially available forms continues though processes of sediment and algal uptake and release. Transport distance from phosphorus sources to impacted receiving waters is recognized as a major factor in determining the

availability and timing of load delivery. Strict control of phosphorus levels from direct and proximal discharges to affected receiving waters is recommended because of the high level of OP delivered from these discharges.[2]

Nutrient loading is directly related to the frequency of runoff events in developed watersheds and can vary by a factor of 3.5 between wet and dry years at the same location (Lung, 1986). High quantities of nitrogen and phosphorus may be transported in surface run-off in the dissolved form or attached to sediments; the relative significance of these two forms may vary seasonally, reflecting differing winter and summer runoff conditions (Jones, 1986; Urbonas and Roesner, 1986). Nitrogen and phosphorus concentrations in storm water from residential and commercial areas may occur at levels sufficient to stimulate excess growth of algae and aquatic macrophytes (i.e., eutrophication), partly because most of these nutrients occur in soluble forms that are readily assimilated by plants (Schueler, 1987).

Nitrate (generally the most stable form of nitrogen) at levels above the drinking water standard of 10 milligrams per liter can cause methemoglobinemia in infants under six months. This rare, but potentially fatal disease limits the oxygen carrying ability of the blood.

B.2.3 Organic Enrichment/Oxygen Demand

Aquatic organisms, such as fish and water-dwelling insects, require minimum levels of dissolved oxygen (DO). Excessive oxygen demanding pollutants can lead to periods of oxygen sag, which may cause fish kills and create anoxic conditions accompanied by foul-smelling odors. Oxygen levels in receiving waters can be lowered by the decomposition of organic matter by microorganisms, by the chemical oxidation of material, or by aquatic vegetation, which uses more oxygen at night than it produces.

Oxygen demand is the term applied to pollutant loads that result in reduced dissolved oxygen levels. The two parameters most commonly used to describe the oxygen demand of

[2] *Phosphorus: A Summary of Information Regarding Lake Water Quality*, IL EPA, August 1986.

pollutants are the 5-day biochemical oxygen demand (BOD5) and chemical oxygen demand (COD). BOD measures oxygen demanding substances that can be metabolized by bacteria and is an indicator of biodegradable organic matter. COD measures oxygen demanding substances that react with an oxidizing chemical in a heated acid bath. COD is an indicator of both organic matter and reduced inorganic chemicals. Of the two, COD is more accurate for the purpose of comparing the oxygen demand of storm water discharges to the oxygen demand of other types of discharges. The BOD5 test underestimates the true oxygen demand of storm water because the heavy metals in the storm water slow the bacterial action used in the test.

Storm water runoff may contain both organic and inorganic pollutants that consume oxygen in receiving waters. Storm water discharges generally occur on overcast days when the amount of sunlight available to oxygen producing plants in water is limited. Lower oxygen production rates increase the adverse impacts of oxygen demanding pollutant loads. Much of the oxygen demanding pollutant load of many types of storm water discharges is associated with suspended solids, which may form deposits in receiving waters. These deposits may result in long periods of low dissolved oxygen through gradual decomposition or may re-suspend during later runoff events. The impacts of oxygen demanding pollutants may be more dramatic in shallow, slow-moving waters due to limited aeration and the tendency of these pollutants to accumulate in bottom sediments of slow-moving waters.

Dissolved oxygen depletions may occur at times substantially different from the actual storm event, which originally discharged the oxygen demanding pollutants. Re-suspension of sediments with attached oxygen demanding pollutants during high flows worsen and delay the dissolved oxygen depletions.

B.2.4 Pathogens

Pathogens are disease-causing organisms, including viruses and some bacteria. Waterborne pathogens may be transmitted to humans or animals through direct recreational

contact, drinking water supplies, or through eating contaminated shellfish. Major pathogen sources include human and animal wastes.

Separate storm sewers, unlike combined storm sewers, are not designed to carry sanitary sewage. However, pathogens may enter separate storm sewers from leaking sanitary sewers, illegal cross connections with sanitary sewers, and malfunctioning septic tanks. In addition, runoff can pick up pathogens from animal wastes on the land. Conditions inside a storm sewer system are often conducive to pathogen reproduction.

Due to difficulties and expenses associated with measuring pathogens directly, bacteria, including total coliform, fecal coliform, and fecal streptococci, are used as indicators of pathogens even though many of these bacteria are harmless. EPA studies indicate that although fecal coliforms are a good indicator of human pathogens for POTW discharges, they are inadequate indicators of human pathogens for many types of storm water discharges (51 *FR* 8012, March 7, 1986). However, most State and local health criteria for recreational contact and shellfish are based on fecal coliform levels, partially due to the low cost of testing procedures. As a result, storm water discharges are responsible for a significant number of restrictions placed on recreational uses and shellfishing.

B.2.5 Toxicity (metals, toxic organics, pesticides, inorganics, and oil and grease)

A wide range of chemicals may exhibit toxicity. Five major classes of chemicals that have toxic impacts recognized in the National Water Quality Inventory are metals, toxic organics, pesticides, inorganic pollutants, and oil and grease.

Toxic impacts may be classified in terms of acute and chronic effects. Acute toxicity refers to lethal concentrations or doses of toxic materials, which result in death of aquatic organisms in a relatively short time. Chronic toxicity refers to impacts, such as the formation of tumors, lowered reproductive, growth, or survival rates, that occur after a longer exposure to toxic substances. Bioaccumulation, or the accumulation of toxic chemicals in tissues of organisms, is another long-term effect of toxic substances that may affect the organism

directly exposed to the chemical, or other animals, including humans, that consume contaminated organisms. For a given chemical constituent (or a mix of constituents) chronic toxicity occurs at lower concentrations than the concentrations that may cause acute effects. However, the exposure time necessary to trigger chronic effects is longer than the exposure times that cause acute effects.

Pollutants that are highly resistant to natural degradation processes are referred to as conservative pollutants. Conservative pollutants have a greater opportunity to cause chronic toxic effects or to bioaccumulate in organisms. Conservative pollutants also have the potential for wider dispersal in the environment through bioaccumulation and subsequent transfer in living organisms, such as fish, plankton, and fish eating birds and mammals. Toxic conservative pollutants include trace metals and some organic compounds, such as chlordane, polychlorinated biphenyls, and other halogenated hydrocarbons. Metals do not degrade, and some organic compounds degrade so slowly that they may remain in sediments for decades.

Many of the toxic metals and other toxic constituents in storm water discharges are attached to suspended solids in the discharge and settle out and accumulate in the bottom sediments of receiving waters where they may persist for long periods of time. Toxics concentrated in bottom sediments may cause adverse impacts on benthic organisms, may become resuspended during high flows resulting from other large storm events, or may dissolve into the water as parameters such as pH and dissolved oxygen change. Accumulated pollutants in bottom sediments may also adversely affect fish during periods of continuous low flow.

B.2.6 Flow Alterations

Activities on the land may cause dramatic changes to the natural hydrologic cycle. Changes in peak flow rates of receiving streams and associated increases in flow velocities cause changes in the stream shape and structure. Increased flow velocities have a greater ability to erode stream beds or stream banks. Stream channels may either be widened or made deeper, with large amounts of soils being swept downstream, forming shifting sandbars

or other sediment deposits. Streams may widen to two to four times their pre-development width if storm water is uncontrolled from developed areas. High erosion rates adversely affect habitat by destroying benthic structures and habitat. High creek flows may also sweep poor swimming fish from the creeks and transport leaf material at higher rates, limiting the availability of food for macroinvertebrate organisms. Channelization projects that drain natural wetlands for development may dramatically alter natural flow patterns. These projects will greatly diminish or destroy the pollutant removal and flow attenuation abilities of the wetlands.

Increased flows associated with urbanization are often accompanied by the installation of extensive channelization projects to increase the flow capacity of the water course and limit erosion damage during storm conditions. Typical channelization projects include riprap, concrete retention walls or lining along stream banks, channel realignment, and diversion of streams through culverts.

After the initial construction of a channelization project is completed, both direct and indirect sources of pollution occur. Channelization projects reduce channel roughness to further increase flow velocities. Increased flow velocities that exceed the stability velocities of the bottom or bank materials cause erosion or scour. Such activity degrades the channel and furnishes sediment for stream transport, destroys natural habitats, and detracts from the aesthetics of the stream. In general, the more extensive the modification, the more damage caused to habitat areas. For example, concrete lining of channels eliminates habitat areas and aesthetic values for practical purposes. Increased channel dimensions may deprive the stream flow of shade from trees along streams banks, resulting in increased water temperatures. These types of projects may worsen downstream flood problems where storm flows are unable to spread out onto a flood plain and increased velocities increase erosion along unprotected banks downstream.

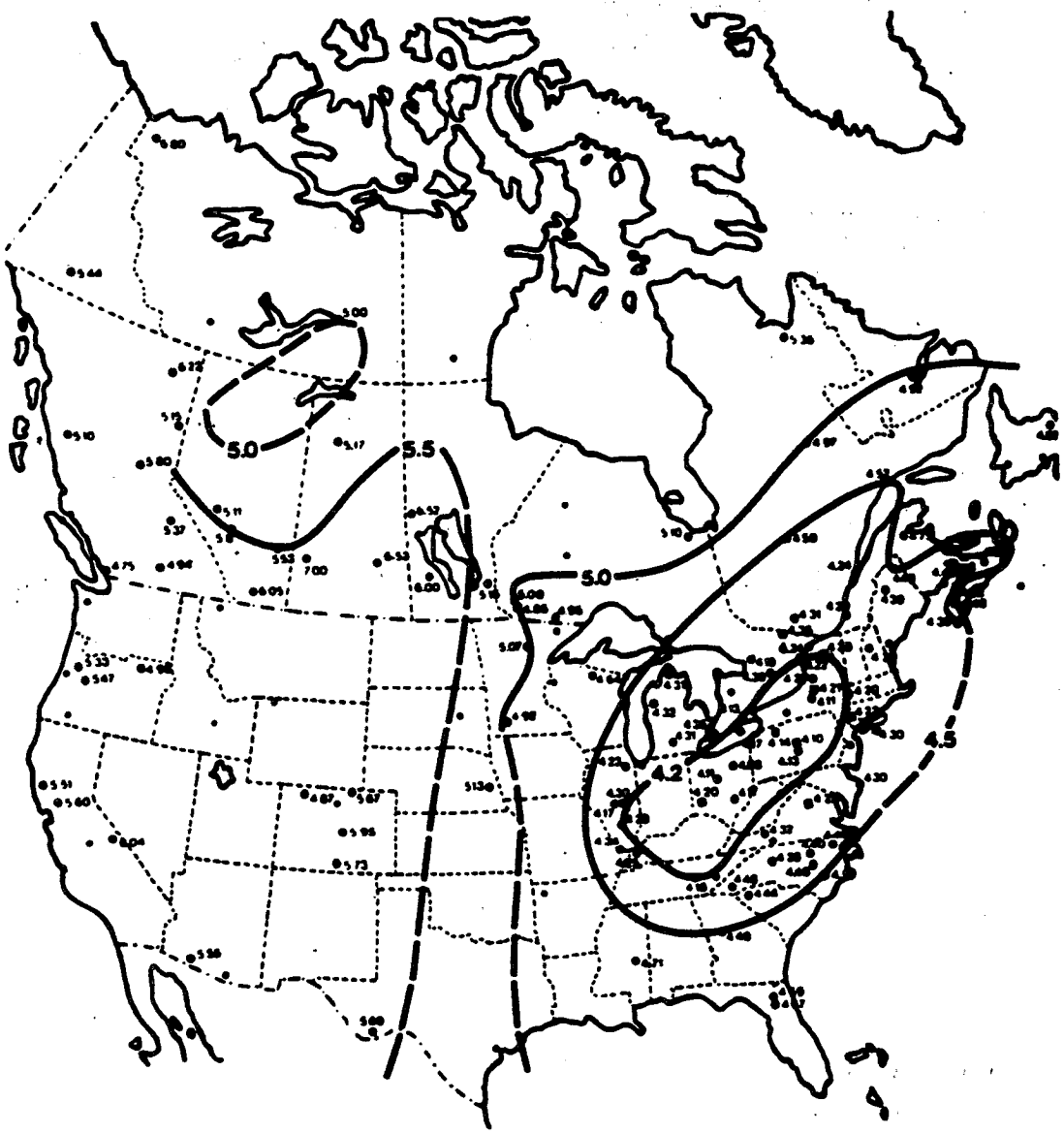
B.2.7 Acidity

Aquatic life may only be supported in a limited range of pHs. Receiving waters that are highly acidic (have a low pH) may be totally devoid of life. In other receiving waters, fish kills may be caused by periodic highly acidic conditions. Periodic episodes of acidity may be particularly harmful to juvenile fish, which tend to be more sensitive and reside in the smaller streams of a watershed, which are more likely to experience wider pH swings. In addition, acidic rain generally will have higher concentrations of heavy metals and other pollutants, which leach under acidic conditions.

Acidity in storm water may be caused by two sources—air pollutants and certain land use activities. Mining is the land use with the most well known acidic storm water discharges. Coal mining in the eastern United States generally involves coal that is high in sulfur and is historically associated with some of the most dramatic water quality impacts caused by acidity.

Nitrogen oxides (NO_x) and sulfur dioxide (SO_2) are the primary air pollutants that result in acid rain and, hence, highly acidic storm water. Acid rain occurs when SO_2, emitted primarily by electric utilities fired by eastern coal, and nitrogen oxides (NO_x), emitted primarily by transportation sources and utilities, are deposited in the form of wet or dry deposition. Rain in the western United States typically has a regional pH of 5.5 or above. Rain in the eastern United States is more acidic, with regional pH values below 4.2 in some regions. More than 80 percent of the SO_2 emissions in the United States originates in the 31 States bordering or east of the Mississippi River, with a heavy concentration from States in or adjacent to the Ohio River Valley. These airborne emissions are transported by prevailing winds to the east. Figure B-2 indicates regional acid rain patterns.

Several aspects of urbanization tend to create local conditions that may make receiving waters susceptible to impacts from acidity. High levels of airborne SO_2 and NO_x in large urbanized areas increases the acidity of the rainfall in the urbanized area to levels above those typically found for the region. Runoff from paved surfaces and other impervious surfaces



Data from four networks are plotted: Canada, CANSAP (circles) and AAPN (squares); United States, NADP (circles) and MAP3S (squares).

Source: Barrie and Hales, 1984.

Figure B-2. Spatial Distribution of the Precipitation-Amount-Weighted Annual Mean Hydrogen-Ion Concentration (expressed as pH) in North America in 1980

may have little or no opportunity to contact soils that may buffer the acidity of the rainfall. In urbanized areas with acidic rain, higher runoff volumes and rates associated with the urban development can increase the acidity of receiving streams rapidly and to high peak acidity levels. This results from more acid being deposited to receiving streams in a shorter amount of time.

B.2.8 Temperature

Increased temperature may have detrimental effects on fish and other aquatic life during various stages of their life cycle. Water holds less oxygen as it gets warmer, which may affect habitat and make the water more susceptible to oxygen demanding pollutants. Sustained water temperatures in excess of 70°F are considered stressful or lethal to many cold water fish species and stream insects. The availability of food, attendant life cycle chemistry, and water quality changes are all affected by water temperature.

During warm weather, the temperature of storm water discharges is generally higher than receiving water temperatures. High volumes of runoff from hot paved surfaces and rooftops may cause a rapid increase in surface water temperatures. Discharges from storm water management devices, which retain collected runoff in unshaded ponds for extended time periods, may also increase stream temperatures.

B.2.9 Floatables, Including Plastics

A large percentage of the litter and plastics that is found on land, if not removed, will eventually be flushed, swept, or blown down a storm sewer. Plastics, metals, and many other types of floatables degrade at extremely slow rates, increasing the time that they remain in receiving waters.

Litter and other floatables degrade aesthetic values, which play a role in the recreational uses of receiving waters, property values of nearby lands, and other broad community-level values. Economic losses caused by the aesthetic degradation of recreational areas, such as

beaches, are significant. Plastic debris presents hazards to wildlife. Ingestion of plastic material by turtles and seabirds appears to present the biggest threat to wildlife. Floatables and plastics may also clog outlet structures of various types of storm water management devices, resulting in flooding or other system malfunctions.

B.3 ADVERSE IMPACTS BY TYPE OF RECEIVING WATER

Impacts on receiving waters associated with storm water discharges may be discussed in terms of three general classes: 1) short-term changes in water quality, 2) long-term water quality impacts, and 3) physical impacts.

Use impairment of receiving streams often is caused by a combination of all three types of impacts. Physical impacts and short-term water quality changes are generally more critical than long-term water quality impacts for receiving waters with relatively short residence times (such as smaller streams and rivers). Receiving waters with long residence times (lakes, estuaries) are generally more sensitive to long-term water quality changes, although certain physical changes, such as loss of reservoir capacity due to siltation, can be important.

Short-term changes in water quality occur during and shortly after storm events. Examples include periodic dissolved oxygen depressions due to oxidation of pollutants, short-term increases in the receiving water concentrations of one or more toxic pollutants, high bacteria levels, and high acidity. These conditions can result in fish kills, loss of submerged macrophytes, and other temporary use impairments.

Long-term water quality impacts are caused by the cumulative effects associated with repeated storm water discharges. These impacts often result from the cumulative effects of pollutants from a number of different types of sources. When evaluating long-term impacts, the cumulative and relative effects of seasonal and long-term pollutant loadings from all relevant sources (e.g., storm water, publicly owned treatment works, industrial discharges, nonpoint sources, atmospheric deposition, in-place pollutants) should be considered.

Examples of the long-term water quality impacts that storm water discharges may cause or contribute to include depressed dissolved oxygen caused by the oxygen demanding pollutants in bottom sediments, biological accumulation of toxics as a result of uptake by organisms in the food chain, chronic toxicity to organisms subject to repeated exposures of toxic pollutants, destruction of benthic habitat, loss of storage capacity in receiving waters, and increased lake eutrophication. Long-term water quality impacts are also caused by pollutants attached to suspended solids that settle in receiving waters and by nutrients that enter receiving water systems with long retention times. In both cases, long-term water quality impacts are caused by increased residence times of pollutants in receiving waters. Long-term water quality impacts of pollutants from storm water discharges may be manifested during critical periods other than during storm events (e.g., during low stream flow conditions and/or during sensitive life cycle stages of organisms).

Physical impacts may occur due to the erosional effects of high-volume flows and high-stream velocities that occur after the natural hydrologic cycle is altered. These changes are often accompanied by the installation of engineered structures, such as concrete walls or underground culverts, which may further degrade the habitat and aesthetic values of the receiving water. In addition, if ground water recharge is limited by the placement of impervious structures on the land, dry weather base flows may be lowered to the detriment of the receiving water.

B.3.1 Rivers and Streams

The *National Water Quality Inventory - 1992 Report to Congress* (EPA, 1992) indicates that the States identified the most extensive causes of impairment in the Nation's rivers as siltation (affecting 45 percent of impaired river miles), nutrients (affecting 37 percent), pathogen indicators (affecting 27 percent), pesticides (affecting 26 percent) organic enrichment/low dissolved oxygen (affecting 24 percent), and metals (affecting 19 percent). Discharges from storm sewers are identified as affecting 11 percent of the impaired river miles. The assessments focused primarily on larger streams and rivers and did not address many of the heavily degraded small streams found in urban areas and elsewhere.

The effect of human activities on the natural hydrologic system may be most evident on smaller streams. Development of a site may dramatically increase the volume and the maximum discharge rate of storm water discharges. Where a sufficient number of sites within the drainage basins of smaller rivers and streams occurs, the stream may experience increases in the magnitude and frequency of flooding, as well as extremely high-stream velocities associated with storm events.

Such changes in the hydrology of a stream may result in accelerated stream bank or stream bed erosion. Such erosion may cause or contribute to a number of generally detrimental effects, including widening or deepening of the stream channel, elimination of pools and other structures in the stream, and shifting of gravel or sand bars. In addition, base flows may be lowered during dry weather.

Streams that have experienced increased flooding or peak velocities often undergo a high degree of additional human flow modification, including channel excavation, lining, realignment, or diversion through underground culverts, which may have, for all practicable purposes, destroyed both fish and wildlife habitat and natural aesthetics. In many cases, highly modified streams are considered to be part of the storm sewer system.

Pollutant concentrations in smaller streams and rivers may experience relatively short-duration increases due to storm water discharges. However, in smaller streams, the concentration of pollutants may be almost as high as the concentrations found in discharges where dry weather base flows are significantly lower than wet weather flows and provide only limited dilution.

Larger rivers often respond slower to storm events than do smaller streams. After a storm event hits a large drainage basin, a given segment of the river may experience degraded water quality for several days because a single location on the river is sequentially affected by pollutants from different upstream sources caused by the same storm. For example, a segment may be influenced by urban runoff, only to then be influenced by agricultural runoff

generated upstream of the storm water source, followed by silvicultural runoff from the river's headwaters.

In many streams, flow velocities slow substantially with increases in stream width or decreases in stream gradient. At these points, sedimentation of fine particles and associated pollutants result. The settled sediments can act as a reservoir for pollutants affecting the water column and the food chain long after the rain has ceased. In addition, disturbance of the deposited sediments by scouring from storm water discharges or combined sewer outfalls, navigation, construction, or dredging may re-introduce the sediments and their pollutants to the water column. The result can be a recurrence of adverse impacts originally associated with the storm water discharge.

The degree of impact on the river or stream depends on a number of factors, including the frequency and duration of the storm water discharges, the quality and quantity of storm water discharges, the occurrence of other wet weather discharges (combined sewer overflow discharges), and the quantity and quality of the base flow (dry weather flow) of the stream. Because larger rivers receive pollutants from a wide variety of sources in urbanized areas, the quality of the base flow may be marginal or poor, thereby increasing the sensitivity of the receiving stream to storm water discharges. In streams with very low base flows, on the other hand, the storm water discharge may be the major determinant of the water quality of the stream.

B.3.2 Lakes and Reservoirs

The most extensive causes of use impairment in lakes are metals (affecting 47 percent of impaired acres), nutrients (affecting 40 percent), organic enrichment/low dissolved oxygen (affecting 34 percent), siltation (affecting 42 percent of impaired acres), and priority organic chemicals (affecting 20 percent). The States reported that 63 percent of lake acres assessed were not fully supporting designated beneficial uses. In addition, the States reported that discharges from separate storm sewers affect 24 percent of the impaired acres of lakes excluding the Great Lakes. Onsite wastewater disposal impaired 16 percent of the impaired

acres. For the Great Lakes, discharges from storm sewers were identified as affecting 11 percent of the impaired shore miles, and land disposal 31 percent of impaired shore miles.

Compared with rivers and streams, lakes and reservoirs have long residence times. The time scale of water quality impacts and recovery may be on the order of years, decades, or even centuries (Manning et al., 1977). The impacts that occur are more likely to be the result of seasonal or annual loadings of pollutants rather than loadings from individual events. Lakes and reservoirs, with longer residence times and slower flow rates, tend to become sinks for many pollutants that attach to the sediments typically carried by storm water. Longer residence time, coupled with poorer aeration, also increases the impacts of nutrients and other oxygen demanding pollutants. The peak concentrations of pollutants in storm water discharges are less important in determining the severity of adverse impacts than the total loading of pollutants delivered to the lake because of the larger capacitance of the system.

In lakes and reservoirs that are deep enough to become thermally stratified, the impacts of introduced pollutants vary seasonally. Pollutants that settled to the bottom attached to solids may become re-introduced into the water column during the strong currents and mixing that can accompany storms, particularly in autumn. This effect has been illustrated dramatically in the Great Lakes (Rosa, 1985; Eadie et al., 1984; Charlton and Lean, 1987).

B.3.3 Estuaries and Coastal Waters

The States reported that the most extensive causes of use impairment in estuaries are nutrients (affecting 55 percent of impaired square miles), pathogen indicators (affecting 42 percent) and organic enrichment/low dissolved oxygen (affecting 34 percent). Discharges from separate storm sewers affected 43 percent of the impaired estuarine area. The States reported that storm sewers affected 59 percent of ocean shore miles and land disposal affected 42 percent of ocean shore miles.

The pattern of water flow in a given estuary results from the effects of tides and density differences between surface and deeper waters. In most estuaries, fresh waters have an

outward, seaward current. Pollutants are initially carried by the fresh water currents. As pollutants attach to sediment and as the flow rates in the estuary slow due to larger flow basins, the pollutants and sediment sink and their outward flow is reversed when they enter heavier, saltier bottom waters that have a net flow landward. As a result, many pollutants remain trapped in estuaries and never reach open waters. Once these sediments have been deposited, they exert long-term effects on water quality through toxicity, bioaccumulation, or nutrient release.

Much of the nutrient load that is present in surface waters can be incorporated into algae, which then settle. As the algae settle, nutrients are released back into the deeper, inflowing waters. As the inflowing waters mix with outflowing surface waters, the nutrients are once again incorporated into algae. This vertical cycling of nutrients in estuaries, referred to as the nutrient trap, allows the slow accumulation of nutrients in the water column. Contributions of nutrients from storm water discharges increase the rate of this nutrient accumulation, worsening the problems of estuarine eutrophication, which is increasingly one of the major focuses of many of the National Estuary Program projects.

B.3.4 Wetlands

Wetlands are generally located adjacent to the other kinds of surface waters. Wetlands buffer the ultimate receiving water by slowing and storing high, wet weather flows and by removing pollutants. In addition, the intensive levels of biological activity in wetlands play an important role in the ecology of the receiving water.

Wetlands are often dredged or filled when development occurs near surface water or near the floodplain. The destruction of wetlands without appropriate storm water management destroys the capability of wetlands to hold runoff and remove pollutants before discharging to other surface waters. This, in turn, results in higher runoff volumes, which discharge to receiving waters at a faster rate.

Wetlands that are used to receive storm water discharges from upland development may also experience impacts. In some cases, the large flow volumes, flow velocities, and pollutant loads delivered by storm water discharges can alter or destroy stable wetland ecosystems. Storm water discharges with high sediment levels from sources such as uncontrolled construction site runoff may fill or alter flow patterns in wetlands over a long time period. Persistent toxics may also accumulate in sediments, vegetation, and the food chain.

If the adverse physical impacts of the storm water discharges can be minimized, the organically rich, shallow, biologically productive wetlands may act as a buffer or treatment for nutrients in storm water, thereby mitigating the impacts of storm water discharges on the receiving waters.

B.3.5 Ground Water

Due to hydrological connections between surface water and ground water, storm water management may affect ground water in two major ways. First, human activities on the land may have dramatic impacts on the hydrologic cycle, increasing the amount of surface runoff and decreasing the amount of infiltration that recharges ground water supplies. Decreasing ground water recharge can lower the water table, which results in lower dry weather base flows in surface waters and may make the operation of wells more costly. Second, pollutants in precipitation and runoff that infiltrates into an aquifer may not be removed by the soil and may enter an aquifer. This may be a particular concern where storm water management techniques used to control flooding and to improve surface water quality infiltrate surface runoff generated by development to an aquifer.

The types of pollutants in the infiltrated precipitation and the subsurface geology determine the beneficial value of infiltrated precipitation for recharging an aquifer or the potential for polluting ground water. Pollutants that are highly soluble in water (e.g., chlorides, nitrates) pass through the overlying soils into the ground water without attenuation. For example, chlorides from highway runoff containing road salt are shown to have adverse

impacts on ground water, as well as surface waters. Other chemical parameters that are less soluble in water tend to adsorb to the soils before reaching ground water supplies.

The potential for ground water contamination strongly depends on the types of land use activities occurring on the surface. Two NURP projects (Long Island, New York, and Fresno, California) addressed sole-source aquifers recharged by runoff from residential and commercial areas for more than two decades. These studies concluded that no change in the use of these practices was warranted. Both studies found that soil processes at the sites were efficient in retaining the pollutants in the runoff close to the land surface, and pollutant breakthrough of the upper soil had not occurred. The EPA report *Class V Injection Wells: Current Inventory; Effects on Ground Water; and Technical Recommendations* (1987), rated the ground water contamination potential of storm water and industrial drainage wells as moderate.

B.4 REGIONAL AND SEASONAL DIFFERENCES

Precipitation patterns vary dramatically in different parts of the United States. A number of parameters are important in characterizing these regional differences, including the duration, intensity, frequency, and annual number of storm events of a given region. Variations in the precipitation patterns of a given region also occur seasonally. These variations affect the volume of storm water discharges produced, can result in seasonal impacts, and may affect management practices. In addition, snow removal and management activities have a special impact on the quality of discharges.

Among the more dominant regional characteristics are the dry summers on the west coast, the abrupt changes in the desert States of the southwest, the peaks occurring in spring and winter in the central gulf and Ohio Valley States, the uniformity of monthly totals throughout the year in the New England States, and snowfall and melt runoff occurring in the northern States.

Seasonal differences may change the nature of storm water discharges and the characteristics of receiving waters. Many smaller rivers in areas with extended dry seasons do not flow all year. The dry seasons in areas like the west coast result in higher than normal pollutant loads associated with the first several storms of the wet season. These discharges may occur when rivers and receiving waters are at low flow levels. Areas with higher intensity storms are prone to flooding and high erosion. Accumulation of pollutants in snow and snow removal activities may adversely affect the quality of snowmelt. In areas were rainfall patterns are non-uniform, soils can become saturated during wet seasons, resulting in higher storm water discharge volumes and erosion rates, as well as overloading of storm water management controls, such as retention and infiltration basins.

Figure B-3 shows 15 rainfall zones for the continental United States that EPA has defined based on annual precipitation statistics.[3] These zones are defined to provide a guide for defining regional patterns, with the geographical area assigned to a zone made as large as possible. Table B-2 summarizes annual precipitation statistics for these zones. The annual precipitation statistics shown in the table only include storm events that were greater than 0.1 inches and consider multiple storms separated by less than a 6-hour period of dry weather as one event. It should be noted that, in general, site-specific data should be used for developing designs for a specific location and that local deviations could be significant, particularly in western parts of the country where mountains, deserts, and coastal patterns result in large differences over relatively small distances.

[3] EPA, *Analysis of Storm Event Characteristics for Selected Rainfall Gages Throughout the United States*, Draft, Driscoll, E.D., et al., November 1989. These 15 rainfall zones represent a refinement of the 10 rainfall zones which appeared in a 1986 draft of the Driscoll reference and which are used in 40 CFR Part 122 Appendix E for the purposes of group applications for storm water discharges associated with industrial activity.

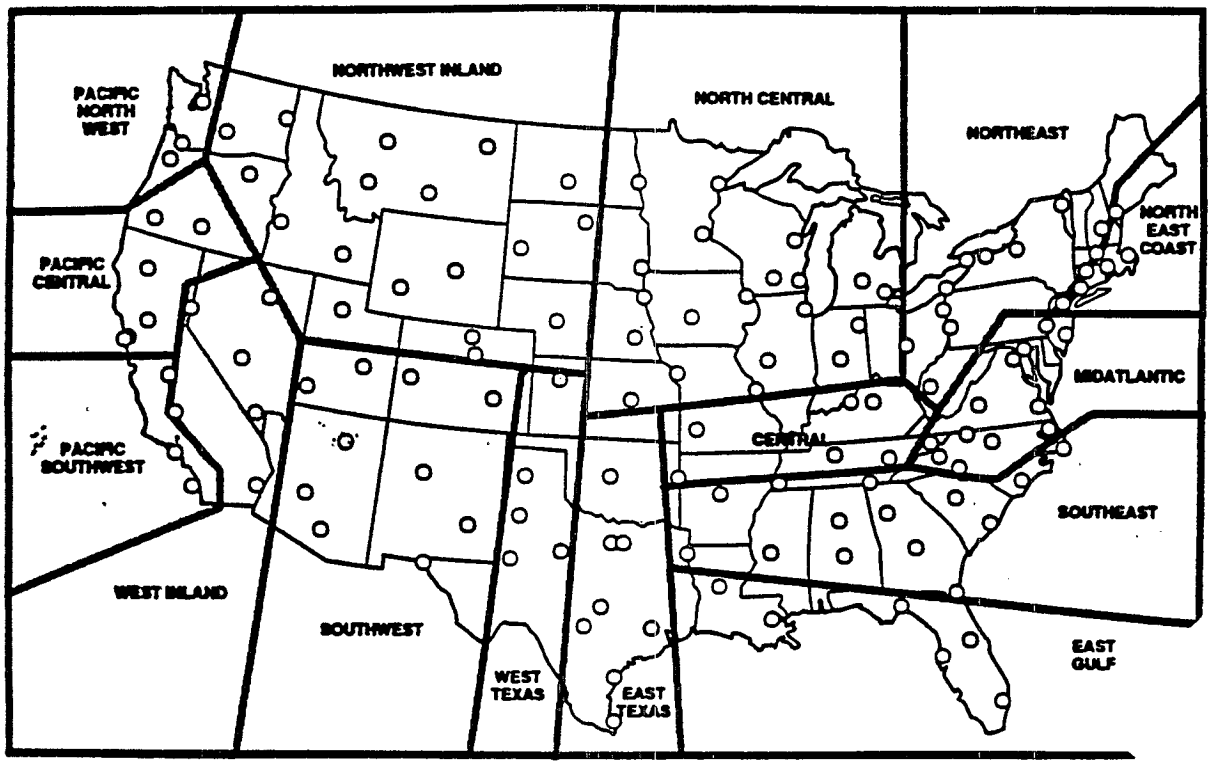


Figure B-3. Rain Zones of the United States

Table B-2. Typical Values of Annual Storm Event Statistics for Rain Zones

Rain Zone	Annual Statistics				Independent Storm Event Statistics							
	No. of Storms		Precipitation		Duration		Intensity		Volume		DELTA	
	Avg	COV	Avg (in)	COV	Avg (hrs)	COV	Avg (in/hr)	COV	Avg (in)	COV	Avg (hr)	COV
Northeast	70	0.13	34.6	0.18	11.2	0.81	0.067	1.23	0.50	0.95	126	0.94
Northeast-Coastal	63	0.12	41.4	0.21	11.7	0.77	0.071	1.05	0.66	1.03	140	0.87
Mid-Atlantic	62	0.13	39.5	0.18	10.1	0.84	0.092	1.20	0.64	1.01	143	0.97
Central	68	0.14	41.9	0.19	9.2	0.85	0.097	1.09	0.62	1.00	133	0.99
North Central	55	0.16	29.8	0.22	9.5	0.83	0.087	1.20	0.55	1.01	167	1.17
Southeast	65	0.15	49.0	0.20	8.7	0.92	0.122	1.09	0.75	1.10	136	1.03
East Gulf	68	0.17	53.7	0.23	6.4	1.05	0.178	1.03	0.80	1.19	130	1.25
East Texas	41	0.22	31.2	0.29	8.0	0.97	0.137	1.08	0.76	1.18	213	1.28
West Texas	30	0.27	17.3	0.33	7.4	0.98	0.121	1.13	0.57	1.07	302	1.53
Southwest	20	0.30	7.4	0.37	7.8	0.88	0.079	1.16	0.37	0.88	473	1.46
West Inland	14	0.38	4.9	0.43	9.4	0.75	0.055	1.06	0.36	0.87	786	1.54
Pacific South	19	0.36	10.2	0.42	11.6	0.78	0.054	0.76	0.54	0.98	476	2.09
Northwest Inland	31	0.23	11.5	0.29	10.4	0.82	0.057	1.20	0.37	0.93	304	1.43
Pacific Central	32	0.25	18.4	0.33	13.7	0.80	0.048	0.85	0.58	1.05	265	2.00
Pacific Northwest	71	0.15	35.7	0.19	15.9	0.80	0.035	0.73	0.50	1.09	123	1.50

COV = Coefficient of Variation = Standard Deviation/Mean
DELTA = Interval between storm midpoints

APPENDIX C

NON-STORM WATER DISCHARGES TO STORM WATER CONVEYANCES

APPENDIX C—NON-STORM WATER DISCHARGES TO STORM WATER CONVEYANCES

Although separate storm sewers are primarily designed to remove runoff from storm events, materials other than storm water find their way into and are ultimately discharged from separate storm sewers. Non-storm water discharges to storm sewers come from a variety of sources (EPA, 1990), including:

- Illicit connections and cross connections from industrial, commercial, and sanitary sewage sources
- Improper disposal of wastes, wastewaters, and litter
- Spills
- Leaking sanitary sewage systems
- Malfunctioning septic tanks
- Infiltration of ground water contaminated by a variety of sources, including leaking underground storage tanks.

One of the significant differences between storm water discharges and discharges from separate storm sewers affected by non-storm water is that non-storm water discharges may occur during dry weather when certain recreational uses of the receiving waters are more prevalent and stream flows are lower. In addition, pollutants from non-storm water discharges may accumulate in separate storm sewers until they are flushed out during a storm event, thereby contributing to higher pollutant concentrations and loads.

A wide range of pollutants may be contributed to storm sewers from non-storm water discharges, including pathogens, metals, nutrients, oil and grease, metals, phenols, and solvents. Removal of these non-storm water sources of pollutants often improves the quality of discharges from separate storm sewers dramatically.

The non-storm water discharges listed previously have a high potential for contributing pollutants to storm sewers (EPA, Pitt, 1992). Other non-storm water discharges may have less potential for contributing pollutants[1]:

- Water from street cleaning drainage
- Water from fire hydrant flushing
- Water from fire fighting activities
- Runoff from noncommercial residential activities, such as lawn watering, car washing, swimming pool discharges
- Water from water line breaks
- Certain cleaning water from commercial activities
- Condensate from residential and commercial air conditioning units
- Infiltration of uncontaminated ground water
- Industrial process wastewater, which has been issued a National Pollutant Discharge Elimination System (NPDES) permit.[2]

C.1 ILLICIT OR CROSS CONNECTIONS

Illicit connections, also referred to as cross connections, to separate storm water sewers are physically connected conveyances used to carry untreated wastewaters other than storm water. For many of these connections, there is a mistaken belief that materials are going to a sanitary sewer or some other type of treatment facility.

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[1] See 55 *FR* 47990 (November 16, 1990) and "Investigations of Inappropriate Pollutant Entries Into Storm Drainage Systems", EPA, January 1993.

[2] EPA has clarified that it does not interpret the effective prohibition on non-storm water discharges to municipal separate storm sewers of Section 402(p)(3) of the CWA to prohibit non-storm water discharges in compliance with the conditions of an NPDES permit that discharge through a municipal separate storm sewer (see November 16, 1990, 55 *FR* 48037).

Illicit connections may take a variety of forms, including improper connections of residential sewer service lines or sumps, cross-connections with sanitary sewers, improper connections of industry sewer lines, and improper disposal of wastes to floor drains or outdoor drains connected to the separate storm sewer.

C.1.1 Improper Installation

In older sections of cities with separate storm sewers, the potential for improper connections to a separate storm sewer may be high. Problems with illicit connections in the oldest developed areas are often traced to the initial development of the storm sewer system (AWPA, 1990). Early storm sewers preceded the development of sanitary sewers. Once storm sewers were in place, however, they received other non-storm water sources of pollutants, some by direct connections and others from wastes dumped into the streets or storm sewers. Many cities prohibited the discharge of domestic sewage to storm sewers but failed to provide public sanitary sewers, resulting in secret illegal connections built without public supervision. Other illegal connections to the storm sewer were overlooked by municipal officials because of the lack of proper sanitary sewers or because the municipality did not have a program addressing the quality of discharges from the storm sewer system.

During redevelopment or infill development, illicit connections may arise when storm sewers are either mistaken for sanitary lines or the developer intentionally installs improper connections to a storm sewer that is more easily accessed than a sanitary sewer. Expanding or retrofitting large, older industrial complexes creates special problems if maps of the sanitary and storm sewer lines do not exist or are inaccurate and confusion arises regarding the appropriate function of the sewer lines. In addition, when the activities within an industrial facility change, floor drains and other discharge points, which are connected to the separate storm sewer, may begin to receive drainage and discharges that should be sent to a treatment plant. Such floor drains may receive a wide variety of discharges, including spills, rinse waters, cooling waters, and even process wastewaters.

Numerous factors may cause floor drains to be directed toward separate storm sewers. Many floor drains in commercial and industrial facilities are positioned so that they collect storm water running into a building, as well as cleaning water, spillage, and other non-storm water discharges generated within a building. Urbanized areas have experienced rapid growth since 1950. During much of that time, many municipalities did not provide adequate publicly owned treatment works (POTW) service; the development of POTW capacity often lagged far behind the rapid development of the urbanized area. When faced with limited POTW capacity or inadequate POTWs, which could not handle toxic materials (e.g., solvents and heavy greases), many municipalities encouraged developers to connect floor drains and other nonsanitary sewage lines from commercial and industrial facilities to separate storm sewers. Some municipal ordinances prohibited floor drains from being connected to the sanitary sewer system.[3] The operators of facilities with these types of improper connections usually do not know whether floor drains and other types of drains discharge to a separate storm sewer or to a sanitary sewer.

Recent studies in Michigan recognized that development that occurred while undersized POTWs were in operation can create wide-spread illicit connections. For example, the Huron River Pollution Abatement Program inspected 660 businesses, homes, and other buildings discharging storm water to the Allen Creek drain in Washtenaw County, Michigan. Of the buildings inspected, 14 percent were identified as having improper storm drain connections. Illicit discharges were detected at a higher rate of 60 percent for automobile-related businesses, including service stations, automobile dealerships, car washes, body shops, and light industrial facilities. While some of the problems discovered in this study were the result of improper plumbing or illegal connections, most connections were approved at the time they were built.

[3] Some municipalities have prohibited floor drain connections to sanitary sewers in overbroad efforts to comply with EPA regulations at 40 *CFR* 35.927-4, which require grant applicants to demonstrate that municipalities have sewer use ordinances prohibiting any new connections from inflow sources into the sanitary sewer portions of the sewer system.

C.1.2 Sewer Maintenance/Restoration

As urban development grows, flows in the sanitary sewer system increase. In some systems where flows during dry or wet weather have grown to exceed the hydraulic capacity of sanitary sewers, the sanitary sewer has been intentionally cross connected to a storm sewer systems. In some cases, formal connections or overflow devices have been installed and, in others, holes are punched into the sanitary sewer to relieve the sanitary sewer of high flows. Some cross-connections result in wet weather combined sewer overflows; others discharge during dry weather events. Discharges from malfunctioning sanitary sewage pumping stations are often directed toward storm sewers.

Incomplete separation of combined sewers may result in significant numbers of cross-connections between the sanitary sewer system and the storm sewer system. Most municipalities separate sewers primarily to prevent basement and street floodings, with secondary consideration given to water quality concerns. Because separation operations are expensive and can cause significant disruptions to street usage, short cuts may be taken to satisfy flooding concerns at the lowest cost. EPA has recently issued a Combined Sewer Overflow (CSO) Control Policy.[4]

C.2 INTERACTIONS WITH SEWAGE SYSTEMS

As sanitary sewage collection systems age, the systems develop leaks and cracks. Municipalities have long recognized the problems of storm water infiltrating into sanitary sewers, because this type of infiltration disrupts the operation of a POTW. However, the reverse problem of sewage exfiltrating out of the sanitary sewer collection system can occur during dry weather periods. Many sanitary collection systems were initially built between the early 1900s and the mid-1950s. Sewer mains were constructed of asbestos cement, bituminous fiber, brick, cast iron, redwood, or vitrified clay. Manholes were prepared from brick and mortar or reinforced concrete. These aged materials, poorly constructed manholes and joints, and main breaks may permit exfiltration. Sewage from a leaky sanitary system

[4] Combined Sewer Overflow (CSO) Control Policy, EPA, 59 *FR* 18688 (April 19, 1994)

can flow to a storm sewer or contaminate ground water supplies. An EPA study on sewer exfiltration found significant ratios of the rate of exfiltration of raw sewage to the rate of infiltration of ground water or storm water into sanitary sewers. Field and laboratory results determined that this ratio varied between 1.5 to 1 and 14 to 1.[5] Not only are the ratio to rates high, but exfiltration can occur during dry periods, as well as wet weather periods; infiltration is more limited to wet weather periods or periods when the water table is high.

Separate storm sewers and sanitary sewers interactions can be caused by numerous conditions. For example, interaction may occur at manholes and where sanitary sewer laterals and storm sewer trenches cross. In addition, separate storm sewers and sanitary sewers may share the same trench, which is generally filled with very porous material, such as gravel.

C.3 IMPROPER DISPOSAL

Improper disposal of materials may result in contaminated discharges from separate storm sewers in two major ways. First, materials may be disposed of directly to a catchbasin or other storm water conveyance. Second, materials disposed of on the ground may either drain directly to a storm sewer or be washed into a storm sewer during a storm event.

Improper disposal to a separate storm sewer often occurs because many believe that disposal of materials to street catchbasins and other separate storm sewer inlets is an environmentally sound practice. Part of the confusion occurs because some areas are served by combined sewers, which are part of the sanitary sewer collection system, and people assume materials discharged to a catchbasin will reach an appropriate sewage treatment plant.

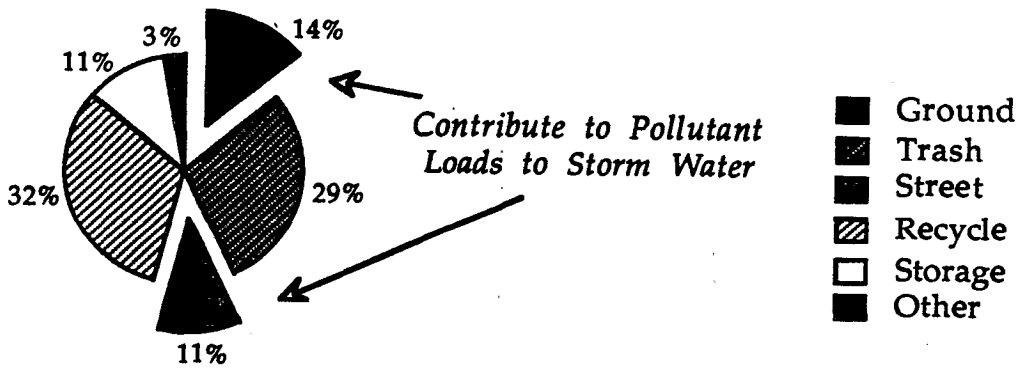
Materials that are commonly disposed of improperly include used oil; household toxic materials; radiator fluids; and litter, such as disposable cups, cans, and fast-food packages.

[5] U.S. EPA, "Results of the Evaluation of Groundwater Impacts of Sewer Exfiltration", Municipal Facilities Division, February 1989, Washington, DC.

A 1984 survey of household disposal practices estimated that the following percentages of households typically disposed of the materials listed directly to a storm sewer or a street:

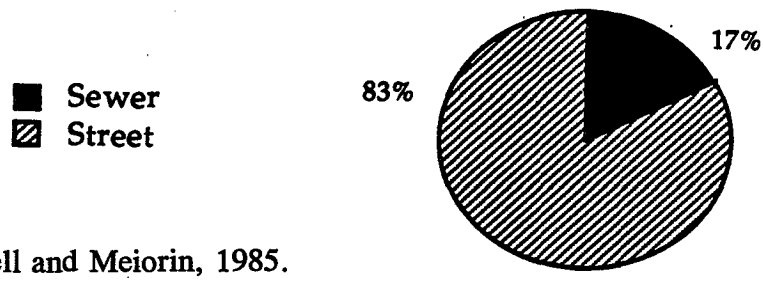
- 3 percent of households—paints and thinners
- 11 percent of households—used motor oil
- 83 percent of households that flushed their own auto radiators—used radiator fluid (anti-freeze contaminated with metals).

In addition, although common practice may have changed since 1985, the study estimated that an additional 14 percent of households that changed their own motor oil disposed of the motor oil by pouring it on the ground. Figures C-1 through C-3 depict these data.



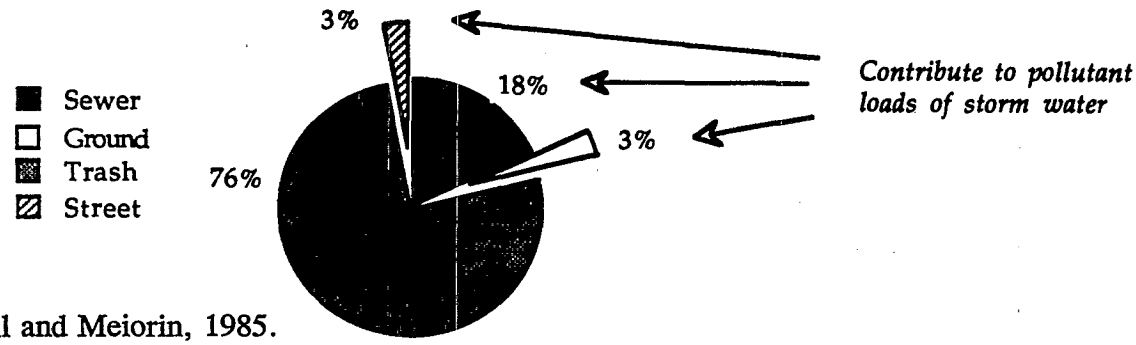
Source: Russell and Meiorin, 1985.

Figure C-1. Disposal Practices of Households Generating Used Motor Oil



Source: Russell and Meiorin, 1985.

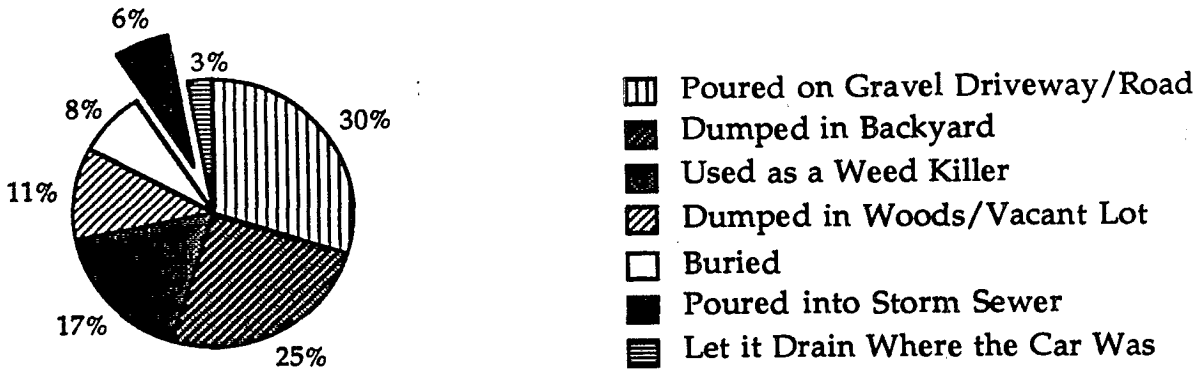
Figure C-2. Disposal Practices of Households Generating Radiator Flushings



Source: Russell and Meiorin, 1985.

Figure C-3. Disposal Practices for Households Generating Waste Paints and Thinner

A Department of Energy study (Brinkman, 1981) addresses common disposal methods of used oil produced by do-it-yourself (DIY) oil changers. The study estimated that 342 million gallons of used oil were drained during DIY oil changes annually and that 40 percent of this used oil was poured on the ground. Figure C-4 shows the variety of types of oil disposal methods used for the 40 percent of DIY oil disposed of by pouring on the ground. EPA estimates that, 267 million gallons of used oil, including 135 million gallons of used oil from DIY automobile oil changes, are disposed of improperly each year.



Source: Brinkman, 1981.

Figure C-4. Disposal Practices of Households Pouring Used Oil on the Ground

The General Accounting Office (GAO) report, *Illegal Disposal of Hazardous Waste: Difficult to Detect or Deter* (1985) investigated illegal dumping of materials defined as hazardous wastes under the Resource Conservation and Recovery Act (RCRA). Although the

report was unable to estimate the extent of illegal dumping of hazardous wastes, it reported that, based on surveyed officials in four States (i.e., Illinois, California, New Jersey, and Massachusetts), some officials believed that many cases of illegal disposal occurred. The report indicated that the Director of EPA's National Enforcement Investigation Center thinks that many cases of criminal disposal occur on a widespread basis, and that EPA receives more allegations than it can handle. The Director stated that the center received about 240 allegations that were judged as having good potential to involve violations during fiscal years 1982 through 1984.

The report indicated that cases of onsite waste disposal where pollutants were added to runoff, which eventually ended up in drainage systems, and cases where a generator dumped wastes directly down a drain, were common. Of the 36 cases of illegal dumping investigated in the GAO report, 14 cases involved disposal of hazardous material directly to or with drainage to a storm sewer, flood control structure, or side of a road. An additional 10 sites involved disposal to the ground, landfills (other than those receiving hazardous wastes), trash bins, which can then result in adding pollutants to subsequent storm water discharges. Disposal scenarios in several other cases could not be determined.

The GAO report concluded that because RCRA regulations and compliance inspections for generators and transporters were not designed to detect illegal disposal, local government agencies, including flood control agencies and departments of transportation were particularly important for detecting illegal dumping.

Businesses disposing of small amounts of hazardous waste may be of concern because they do not fully understand hazardous waste disposal regulations and employee training programs necessary to ensure proper disposal.

C.4 SPILLS

Spilled material may have a have a high potential for entering human-made drainage systems. Until recently, an accepted practice to responding to spills was to flush the spilled

material away. These removal methods may often result in flushing the spilled material into a separate storm sewer.

A wide variety of materials, such as petroleum products, other liquid products, and waste chemicals, may spill during transportation, transfer, use, and storage. The U.S. Coast Guard's National Response Center (NRC) receives thousands of incident reports, involving hundreds of substances each year. Summary data, provided by the NRC, categorized spilled materials as either oil or hazardous substances defined under the CWA or the Comprehensive Environmental Response, Compensation, and Liability Act. The term oil is used to represent more than 90 different materials, including various grades of crude oil, naphtha, coal tar, creosote, refined oils, gasoline, and jet fuel.

Table C-1 summarizes the amounts of reported oil and hazardous substances discharged and the amounts reported in water during 1987 and 1988. As this table shows, significant quantities of pollutants are reported to the NRC as spilled or dumped each year. Cleanup activities are not initiated for each reported discharges. Where cleanup occurs, a significant portion of a spill is often not recoverable. Although no data are available to substantiate the number of unreported discharges, Merryman (1989) estimated that less than half of the reportable incidents occurring each year are reported to the NRC. Many of these incidents probably involve little cleanup activity because they were not reported to responsible authorities.

C.5 MALFUNCTIONING SEPTIC SYSTEMS

In rural and suburban areas served by septic systems, malfunctioning septic systems can contribute pollutants to separate storm sewers. Although septic systems work well in rural, low-density areas with suitable soil and a deep water table, septic systems are often installed in inappropriate areas, such as coastal areas, where rapid residential growth, particularly in second-home development areas, has outdistanced the ability of local governments to build sanitary sewers.

Table C-1. Summary of U.S. Coast Guard National Response Center Data on Discharges of Oil and CERCLA-Regulated Materials During 1987 and 1988

	1987 Gallons	1987 Pounds	1988 Gallons	1988 Pounds
Oil Spills Affecting Land	4,988,282	--	6,426,228	--
Oil Spills Affecting Water	3,613,555	--	4,637,600	--
Oil Spills Amount in Water	5,278,773	--	2,949,694	--
Hazardous Substances Spills Affecting Land	1,969,080	3,354,591	4,201,392	2,565,142
Hazardous Substances Spills Affecting Water	3,664,065	656,843	5,244,696	856,852
Hazardous Substances Spills Amount in Water	3,636,764	347,230	2,320,874	415,204

Oil is defined by the NRC to include 94 materials, including gasoline, crude and refined oils, creosote, jet fuel, diesel, naphtha, and coal tar.

Hazardous Substances include 494 materials either required by or containing substances regulated by CERCLA.

Surface malfunctions are caused by clogged or impermeable soils or when stopped up or collapsed pipes force untreated wastewater to the surface. Surface malfunctions can vary in degree from occasional damp patches on the surface to constant pooling or runoff of wastewater to a storm sewer. These discharges have high bacteria, nitrate, and nutrient levels and can contain a variety of household chemicals. One type of improper remedy to a surface malfunction is to install a pipe or trench over soil absorption systems to route untreated surface malfunction overflow away from the septic system, resulting in direct discharges to drainage ditches, empty lots, or surface waters.

Malfunctioning septic systems may be a more significant surface runoff pollution problem than a ground water problem. This is because a malfunctioning septic system is less likely to cause ground water contamination where a bacterial mat in the soil retards the downward movement of wastewater. (Poorly located septic systems that are operating properly are the greatest threat to ground water.)

In addition to surface malfunctions, insufficiently treated wastewater from a septic system may contaminate ground water, which may infiltrate into storm sewers, which serve as a

conduit to surface waters. Also, seepage of sewage or effluent into underground portions of buildings can be pumped to separate storm sewers.

The 1992 Needs Survey estimates that approximately 30 percent of the population in the United States is served by septic systems[6].

C.6 INFILTRATION OF CONTAMINATED GROUND WATER

Many separate storm sewers discharge ground water that infiltrates into the storm sewer. Usually, these discharges are not contaminated and, in general, do not pose direct pollutant threats to surface waters. However, if ground water sources are contaminated by industrial or other sources, the separate storm sewer serves as a conduit for the contaminated ground water to surface waters. This process can greatly reduce pollutant removal associated with ground water migration through soils, as well as reduce the dilution processes associated with ground water plume migration. Conversely, observing contaminated discharges from separate storm sewers during dry weather may be used as a tool to detect sources of ground water contamination.

In addition to traditional industrial sources, ground water may be contaminated by a number of commercial activities. One leading cause of ground water contamination from commercial activities includes leaks from underground storage tanks (USTs) and underground pipes. Underground storage tanks are used to store large amounts of potential pollutants, such as petroleum products and chemicals. In 1987, EPA estimated that 676,000 UST systems stored retail motor fuel, 651,000 stored other petroleum products, and 54,000 stored hazardous chemicals in the United States. In addition, EPA estimated that potentially millions of other small UST systems, such as hydraulic lift tanks and power cable conduits, contain dielectric fluid. Pollutants leaking from these tanks may infiltrate through soil into either nearby ditches or storm water pipes (Fields, 1989). A draft EPA report (Kaschak and Hargrove, 1988) reviewed corrective action case histories of 50 leaking UST sites. The report indicated

[6] "1992 Needs Survey Report to Congress", EPA, September 1993.

that surface water impacts were of concern at 14 percent of these sites, where fuels entered storm drains or flowed over the surface, or where the source was located close to a stream or surface waters.

C.7 ROAD OILING

EPA estimates that 70 million gallons of used oil, primarily supplied by service stations and repair shops, are used for road oiling.

A study of two rural roads in New Jersey treated with waste crankcase oil indicated that only 1 percent of the total oil applied to the road may remain on the road surface (Freestone "Runoff of oils from rural roads treated to suppress dust" NERC, EPA, Cincinnati, OH, 1972). The study concluded that oil could have left the road surface by several means such as volatilization, runoff, adhesion to vehicles, adhesion to dust particles with wind transport, and biodegradation.

APPENDIX D

NPDES STORM WATER PROGRAM QUESTION AND ANSWER DOCUMENT VOLUMES I AND II

NPDES

Storm Water Program

Question and Answer Document

U.S. Environmental Protection Agency
Office of Wastewater Enforcement and Compliance
Permits Division
401 M Street, SW
Washington, DC 20460

March 1992

INDUSTRIAL PERMIT APPLICATION QUESTIONS AND ANSWERS

Category i - Facilities subject to storm water effluent guidelines, new source performance standards, or toxic pollutant effluent standards.

1. What kinds of facilities are included under category (i)?

Category (i) includes facilities subject to storm water effluent limitations guidelines, new source performance standards, or toxic pollutant effluent standards under Title 40 subchapter N of the Code of Federal Regulations (CFR) (except facilities with toxic pollutant effluent standards which are exempted under category (xi) of the definition of storm water discharge associated with industrial activity). The term "storm water" modifies only "effluent limitations guidelines." Facilities subject to subcategories with new source performance standards, toxic pollutant effluent standards, or storm water effluent limitation guidelines are required to submit a National Pollutant Discharge Elimination System (NPDES) permit application for storm water discharges associated with industrial activity.

2. What kinds of facilities are subject to storm water effluent guidelines?

The following categories of facilities have storm water effluent guidelines for at least one of their subcategories: cement manufacturing (40 CFR 411); feedlots (40 CFR 412); fertilizer manufacturing (40 CFR 418); petroleum refining (40 CFR 419); phosphate manufacturing (40 CFR 422); steam electric power generation (40 CFR 423); coal mining (40 CFR 434); mineral mining and processing (40 CFR 436); ore mining and dressing (40 CFR 440); and asphalt (40 CFR 443). A facility that falls into one of these general categories should examine the effluent guideline to determine if it is categorized in one of the subcategories that have storm water effluent guidelines. If a facility is classified as one of those subcategories, that facility is subject to the standards listed in the CFR for that category, and as such, is required to submit a storm water discharge permit application.

3. What kinds of facilities are subject to "toxic pollutant effluent standards"?

First, it is important to understand the term toxic pollutant. Toxic pollutants refers to the priority pollutants listed in Tables II and III of Appendix D to 40 CFR part 122 (not 40 CFR Part 129). If any of these toxic pollutants are limited in an effluent guideline to which the facility is subject (including pretreatment standards), then the facility must apply for a storm water permit.

The following categories of facilities have toxic pollutant effluent standards for at least one subcategory:

Textile mills (40 CFR 410)
Electroplating (40 CFR 413)
Organic chemicals, plastics, and synthetic fibers (40 CFR 414)
Inorganic chemicals (40 CFR 415)
Petroleum refining (40 CFR 419)
Iron and steel manufacturing (40 CFR 420)
Nonferrous metals manufacturing (40 CFR 421)
Steam electric power generating (40 CFR 423)
Ferroalloy manufacturing (40 CFR 424)
Leather tanning and finishing (40 CFR 425)
Glass manufacturing (40 CFR 426)
Rubber manufacturing (40 CFR 428)
Timber products processing (40 CFR 429)
Pulp, paper, and paperboard (40 CFR 430)
Metal finishing (40 CFR 433)
Pharmaceutical manufacturing (40 CFR 439)
Ore mining and dressing (40 CFR 440)
Pesticide chemicals (40 CFR 455)
Photographic processing (40 CFR 459)
Battery manufacturing (40 CFR 461)
Metal molding and casting (40 CFR 464)
Coil coating (40 CFR 465)
Porcelain enameling (40 CFR 466)
Aluminum forming (40 CFR 467)
Copper forming (40 CFR 468)
Electrical and electronic components (40 CFR 469)
Nonferrous metals forming and metal powders (40 CFR 471)

4. What kinds of facilities are subject to "new source performance standards"?

Most effluent guidelines listed in subchapter N contain New Source Performance Standards (NSPS). A facility that is subject to a NSPS as defined for that particular effluent guideline is required to submit a permit application for the storm water discharges associated with industrial activity at that site. The definition of a new source varies based on the publication date of the particular effluent guideline.

The following categories of 40 CFR Subchapter N facilities do <u>not</u> have new source performance standards. All other categories have at least one subcategory with new source performance standards.

Oil and Gas Extraction (40 CFR 435)
Mineral Mining and Processing (40 CFR 436)
Gum and Wood Chemicals Manufacturing (40 CFR 454)
Pesticide Chemicals (40 CFR 455)
Explosives Manufacturing (40 CFR 457)
Photographic (40 CFR 459)
Hospital (40 CFR 460)

5. If a facility is included under the description of both category (i) and category (xi), is that facility required to submit a storm water permit application if material handling equipment or activities, raw materials, intermediate products, final products, waste materials, by-products, or industrial machinery are not exposed to storm water?

The answer depends on why the facility is included in category (i). If the facility is included in category (i) because it is subject to storm water effluent standards or new source performance standards, the facility is required to apply for a permit regardless of whether it has exposure or not. Facilities that are included in category (i) only because they have toxic pollutant effluent standards are not required to submit an application if they indeed have no exposure to material handling equipment or activities, raw materials, intermediate products, final products, waste materials, by-products, or industrial machinery.

Categories ii, iii, vi, viii, and xi

6. What industrial groups are covered by Standard Industrial Classification (SIC) codes that are used in the definition of storm water discharge associated with industrial activity?

The following SIC codes and associated industries are included in the indicated categories of the definition:

Category (ii)
24 (except 2434) - Lumber and Wood Products (except wood kitchen cabinets)
26 (except 265 and 267) - Paper and Allied Products (except paperboard containers and products)
28 (except 283 and 285) - Chemicals and Allied Products (except drugs and paints)
29 - Petroleum Refining Industries
311 - Leather Tanning and Finishing

32 (except 323) - Stone/Clay/Glass and Concrete Products (except glass products made of purchased glass)
33 - Primary Metal Industries
3441 - Fabricated Structural Metals
373 - Ship and Boat Building and Repairing

Category (iii)
10 - Metal Mining
12 - Coal Mining
13 - Oil and Gas Extraction
14 - Nonmetallic Minerals

Category (vi)
5015 - Motor Vehicles Parts, Used
5093 - Scrap and Waste Materials

Category (viii)
40 - Railroad Transportation
41 - Local Passenger Transportation
42 (except 4221-4225) - Trucking and Warehousing (except public warehousing and storage)
43 - U.S. Postal Service
44 - Water Transportation
45 - Transportation by Air
5171 - Petroleum Bulk Stations and Terminals

Category (xi)
20 - Food and Kindred Products
21 - Tobacco Products
22 - Textile Mill Products
23 - Apparel Related Products
2434 - Wood Kitchen Cabinets Manufacturing
25 - Furniture and Fixtures
265 - Paperboard Containers and Boxes
267 - Converted Paper and Paperboard Products
27 - Printing, Publishing, and Allied Industries
283 - Drugs
285 - Paints, Varnishes, Lacquer, Enamels, and Allied Products
30 - Rubber and Plastics
31 (except 311) - Leather and Leather Products (except leather tanning and finishing)
323 - Glass Products
34 (except 3441) - Fabricated Metal Products (except fabricated structural metal)

35 - Industrial and Commercial Machinery and Computer Equipment
36 - Electronic and Other Electrical Equipment and Components
37 (except 373) - Transportation Equipment (except ship and boat building and repairing)
38 - Measuring, Analyzing, and Controlling Instruments
39 - Miscellaneous Manufacturing Industries
4221-4225 - Public Warehousing and Storage

Category iii - Mining and Oil & Gas Operations

7. Are inactive mines included in the regulation?

Two conditions must be met for an inactive mine to be required to submit a storm water discharge permit application. First, the facility must have a discharge of storm water that has come into contact with any overburden, raw material, intermediate products, finished products, byproducts, or waste products located on the site of the facility. The second condition depends on the type of mining activity.

Inactive non-coal mining operations must apply until such sites are released from applicable State or Federal reclamation requirements after December 17, 1990. Non-coal mining operations released from applicable State or Federal requirements before December 17, 1990, must apply for an NPDES storm water discharge permit if the storm water discharges are contaminated as discussed above.

Inactive coal mining operations must apply unless the performance bond issued to the facility by the appropriate Surface Mining Control and Reclamation Act (SMCRA) authority has been released.

8. Are any oil & gas exploration, production, processing, or treatment operations, or transmission facilities classified under SIC code 13, exempt from having to apply for a storm water permit?

Yes, such facilities are exempt unless they have discharged storm water after November 16, 1987, containing a Reportable Quantity (RQ) of a pollutant for which notification is or was required pursuant to 40 CFR 117.21, 40 CFR 302.6, or 40 CFR 110.6; or if a storm water discharge from the facility contributes to a violation of a water quality standard, as set forth in 40 CFR 122.26(c)(1)(iii).

9. What is a reportable quantity for discharges from an oil or gas operations?

As defined at 40 CFR 110.6, an RQ is the amount of oil that violates applicable water quality standards or causes a film or sheen upon or a discoloration of the surface of the water or adjoining shorelines or causes a sludge or emulsion to be deposited beneath the surface of the water or upon adjoining shorelines (40 CFR part 110.6). The RQs for other substances are listed in 40 CFR 117.3 and 302.4 in terms of pounds released over any 24-hour period.

10. Are access roads for mining operations covered?

Any construction that disturbs 5 acres or more of total land area must apply for a storm water discharge permit.

After construction, roads for mining operations would not be included unless storm water runoff from such roads mixes with storm water that is contaminated by contact with overburden, raw materials, intermediate products, finished products, byproducts, or waste products. When roads are constructed out of materials such as overburden or byproducts, an application for an NPDES storm water discharge permit would be required.

Category iv - Hazardous Waste Treatment, Storage, or Disposal Facilities

11. Is a facility that stores hazardous waste less than 90 days required to submit an application?

It is EPA's intent to cover those facilities that are operating under interim status or permit under the Resource Conservation and Recovery Act (RCRA) subtitle C. As such, only facilities meeting the definition of a hazardous waste treatment, storage, or disposal facility under RCRA are expressly included in this category. A facility that stores hazardous waste less than 90 days is not considered to be a treatment, storage, or disposal facility, and therefore is not required to submit a storm water permit application.

Category v - Landfills, Land Application Sites and Open Dumps

12. Do closed or inactive landfills need to apply for a permit?

Yes. Any landfill, active, inactive or closed, must apply for a permit if it receives, or has received, wastes from the industrial facilities identified under 122.26(b)(14)(i)-(xi). To the extent that control measures and best management practices address storm water, the permit may incorporate those control measures.

13. Does a landfill that receives only the office waste and/or cafeteria waste from industrial facilities have to apply for an NPDES permit?

No. Only landfills that receive or have received waste from manufacturing portions of industrial facilities need to apply for a permit.

Category vi - Recycling Facilities

14. Are gas stations or repair shops that collect tires or batteries classified in the "recycling" category?

No. Only those facilities classified in SIC codes 5015 (used motor vehicle parts) and 5093 (scrap and waste materials) are in the "recycling" category. This includes facilities such as metal scrap yards, battery reclaimers, salvage yards, and automobile junk yards.

15. Are municipal waste collection sites included in category (vi)?

No. Municipal waste collection sites where bottles, cans, and newspapers are collected for recycling purposes are not classified as SIC codes 5015 or 5093.

Category vii - Steam Electric Power Generating Facilities

16. Are offsite transformer areas regulated under the NPDES storm water rule?

No. Upon examination of the Toxic Substances Control Act, EPA determined that the regulation of storm water discharges from these facilities should be studied under Section 402(p)(5) of the Clean Water Act (CWA) (55 FR 48013). Future regulations may be developed to address these areas.

17. Are storm water discharges from electrical substations included in the definition of industrial activity?

No. Electrical substations are not covered by this regulation.

18. Are storm water discharges from coal piles that are located offsite from the power station included in the definition of industrial activity?

No. Offsite coal piles are not covered by this regulation. In order to be included, a coal pile must be located on the site of a facility defined by the regulation as being "engaged in an industrial activity."

19. Are storm water discharges from co-generation facilities included in the definition of industrial activity?

A heat capture co-generation facility is not covered under the definition of storm water discharge associated with industrial activity; however, a dual fuel co-generation facility is included and therefore must submit an application for the storm water discharges associated with industrial activity.

20. Are university power plants included in the definition of industrial activity?

Yes. A university steam electric power generating facility is required to apply for a storm water discharge permit.

Category viii - Transportation Facilities

21. Are gas stations and automotive repair shops required to apply for an NPDES storm water discharge permit?

No. These facilities are classified in SIC codes 5541 (gasoline filling stations) and 7538 (automotive repair shops). The storm water rule generally does not address facilities with SIC classifications pertaining to wholesale, retail, service or commercial activities. Additional regulations addressing these sources may be developed under Section 403(p)(6) of the CWA if studies required under Section 402(p)(5) indicate the need for regulation.

22. Does a vehicle maintenance shop or an equipment cleaning facility need to apply for a permit?

Yes, if the shop is categorized by the SIC codes listed in the transportation category of facilities engaged in industrial activity [i.e., SIC codes 40, 41, 42 (except 4221-25) 43, 44, 45 and 5171]. Only the vehicle maintenance (including vehicle rehabilitation, mechanical repairs, painting, fueling, and lubrication) and equipment cleaning areas (such as truck washing areas) must be addressed in the application.

As explained above, gas stations are classified in SIC code 5541 and automotive repair services are classified as SIC code 75, which are not included in the regulatory definition of industrial activity, and therefore are not required to submit NPDES storm water discharge permit applications.

23. Are municipally owned and/or operated school bus maintenance facilities required to apply for an NPDES permit?

No. The SIC Manual states that "school bus establishments operated by educational institutions should be treated as auxiliaries" to the educational institution. Since the SIC code assigned to educational institutions is 82, the municipally operated (i.e., by a school board, district, or other municipal entity) school bus establishments would not be required to apply for an NPDES permit for their storm water discharges. Private contract school bus services are required to apply for an NPDES permit for their storm water discharges.

24. Is SIC code 4212 always assigned to facilities with dump trucks?

No. The maintenance facility must be primarily engaged in maintaining the dump truck to be characterized as SIC code 4212. Dump trucks used for road maintenance and construction and facilities that maintain these trucks are classified under SIC code 16 (heavy construction other than building construction) and therefore would not be characterized as engaging in industrial activity.

25. How does a municipality determine what type of vehicle a particular maintenance facility is primarily engaged in servicing?

The SIC Manual recommends using a value of receipts or revenues approach to determine what is the primary activity of a facility. For example, if a maintenance facility services both school buses and intercity buses, the facility would total receipts for each type of vehicle and whichever generated the most revenue, would be the vehicle type that the facility is primarily engaged in servicing. If data on revenues and receipts are not available, the number of vehicles and frequency of service may be compared. If a facility services more than two types of vehicles, whichever type generates the most (not necessarily greater than half of the total) revenue, or is most frequently serviced, is the vehicle type the facility is primarily engaged in servicing.

26. Is a municipal maintenance facility that is <u>primarily</u> engaged in servicing garbage trucks required to apply for a permit?

The answer depends on the SIC code assigned to the establishment. If the municipality also owns the disposal facility (e.g., landfill, incinerator) that receives refuse transported by the trucks, then the maintenance facility would be classified as SIC code 4953 and thus would not be required to apply for a permit unless the maintenance facility was located at a facility covered under one of the other categories of industrial activity (e.g., a landfill that receives industrial waste). If, however, the municipality does not own the disposal facility, the truck maintenance facility would be classified as SIC code 4212 and thus would be required to apply for a permit. If other vehicles are serviced at the same maintenance facility, the facility may not be required to submit a permit application (see question #25 above).

27. Are fire trucks or police cars included in the transportation SIC codes?

No. The operation of fire trucks and police cars are classified under public order and safety (SIC code 92); therefore, the operator of a facility primarily engaged in servicing those vehicles would not be required to apply for a permit.

28. Do all airports need to apply for a storm water discharge permit?

No, only those airports classified as SIC code 45. Only those portions of the facility that are either involved in vehicle maintenance (including vehicle rehabilitation, mechanical repairs, painting, fueling, and lubrication), equipment cleaning, or airport deicing or which are otherwise identified under 122.26(b)(14)(i)-(vii) or (ix-xi) are required to be permitted. Airports that are not engaged in such activities do not require storm water discharge permits. Facilities primarily engaged in performing services that incidentally use airplanes (e.g., crop dusting and aerial photography) are classified according to the service performed.

29. Is the deicing of airplanes, runways, or both included in airport deicing operations?

Airports or airline companies must apply for a storm water discharge permit for locations where deicing chemicals are applied. This includes, but is not limited to, runways, taxiways, ramps, and areas used for the deicing of airplanes. The operator of the airport should apply for the storm water discharge permit with individual airline companies included as co-applicants.

30. Who is responsible for seeking permit coverage at an airport that has many companies using the facility and discharging storm water?

The operator is responsible for seeking coverage. EPA strongly encourages cooperation between the airport authority and all operating airlines at that airport. Each operator is responsible for coordinating with the others and they may act as co-applicants. Please note that under 122.26(a)(6) the Director has the discretion to issue individual permits to each discharger or to issue an individual permit to the airport operator and have other dischargers to the same system act as co-permittees to the permit issued to the airport operator.

31. Are railroad facilities included?

Railroad facilities, classified as SIC code 40, which have vehicle maintenance activities, equipment cleaning operations or are otherwise identified under 122.26(b)(14)(i)-(vii) or (ix)-(xi) need to apply for a permit.

32. Are repairs along a railroad system considered to be vehicle maintenance and thus regulated?

No. Only nontransient vehicle maintenance shops are included in the transportation category.

33. Are tank farms at petroleum bulk storage stations covered by the rule?

No, unless the storm water discharge from the tank farm area commingles with storm water from any vehicle maintenance shops or equipment cleaning operations located onsite. However, tank farms located onsite with other industrial facilities, as defined in 122.26(b)(14), are included in the regulation.

34. Is a parking lot associated with a vehicle maintenance shop included in the regulation?

Yes. Under 122.26 (b)(14)(viii) vehicle maintenance and equipment cleaning operations are considered industrial activity. Parking lots used to store vehicles prior to maintenance are considered to be a component of the vehicle maintenance activity.

35. Is the fueling operation of a transportation facility (SIC codes 40 through 45) covered if there are no other vehicle maintenance activities taking place at the facility?

Yes. A nonretail fueling operation is considered vehicle maintenance [see 122.26(b)(14)(viii)] and requires an NPDES storm water discharge permit application.

36. Is a manufacturing facility's offsite vehicle maintenance facility required to apply for a permit under the transportation category?

No. An offsite vehicle maintenance facility supporting one company would not be required to apply for a permit if that company is not primarily engaged in providing transportation services and therefore would not be classified as SIC

code 42. The maintenance facility would be considered an auxiliary operation to the manufacturing facility. For a full discussion on auxiliary facilities see page 13 through 17 of the 1987 Standard Industrial Classification Manual. If the maintenance facility is located on the same site as the manufacturing operation, it would be included in the areas associated with industrial activity and must be addressed in an application.

37. Is a marina required to apply for a storm water permit if it operates a retail fueling operation, but other vehicle maintenance or equipment cleaning activities are not conducted onsite?

Facilities that are "primarily engaged" in operating marinas are best classified as SIC 4493 - marinas. These facilities rent boat slips, store boats, and generally perform a range of other marine services including boat cleaning and incidental boat repair. They frequently sell food, fuel, fishing supplies, and may sell boats. For facilities classified as 4493 that are involved in vehicle (boat) maintenance activities (including vehicle rehabilitation, mechanical repairs, painting, fueling, and lubrication) or equipment cleaning operations, those portions of the facility that are involved in such vehicle maintenance activities are considered to be associated with industrial activity and are covered under the storm water regulations.

Facilities classified as 4493 that are not involved in equipment cleaning or vehicle maintenance activities (including vehicle rehabilitation, mechanical repairs, painting, and lubrication) are not intended to be covered under 40 CFR Section 122.26(b)(14)(viii) of the storm water permit application regulations. The retail sale of fuel alone at marinas, without any other vehicle maintenance or equipment cleaning operations, is not considered to be grounds for coverage under the storm water regulations.

Marine facilities that are "primarily engaged" in the retail sale of fuel and lubricating oils are best classified as SIC code 5541 - marine service stations - and are not covered under 40 CFR Section 122.26(b)(14)(viii) of the storm water permit application regulations. These facilities may also sell other merchandise or perform minor repair work.

Facilities "primarily engaged" in the operation of sports and recreation services such as boat rental, canoe rental, and party fishing, are best classified under SIC code 7999 - miscellaneous recreational facilities - and are not covered under 40 CFR Section 122.26(b)(14)(viii).

Category ix - Sewage Treatment Works

38. Are storm water permit applications required for offsite (i.e., physically separated from the main treatment works property) pumping stations?

No, storm water permit applications are not required for such sites.

39. Are separate permit applications required for vehicle maintenance/ washing facilities (located either onsite or offsite) associated with a wastewater treatment plant and owned/operated by the wastewater treatment agency?

Offsite vehicle maintenance facilities would not be required to submit applications unless they serve multiple clients since they do not fit the SIC codes listed in the transportation category of facilities engaged in industrial activity. Onsite vehicle maintenance/cleaning operations are associated with industrial activity and must be included in the application.

40. Do wastewater treatment facilities that collect their storm water runoff and treat the storm water as part of the normal inflow that is processed through the treatment plant have to apply for a permit?

No. If a facility discharges its storm water into the headworks of the treatment plant, it is essentially the same as discharging to a combined system or to a sanitary system and is therefore exempt from the requirements of 122.26(c).

41. The definition states that offsite areas where sludge is beneficially reused are not included as storm water discharges associated with industrial activity. How is beneficial reuse defined?

Beneficial sludge reuse is the application of sludge as a nutrient builder or soil conditioner. Examples include agricultural or domestic application.

Category x - Construction Activities

42. Is a construction site of five acres or more subject to the same deadline as other industrial facilities?

The individual application deadline for all storm water discharges associated with industrial activity is 10/1/92. If a construction activity is completed by 10/1/92, an application is not required.

43. What is the duration of an NPDES permit issued for a construction activity?

The permit will be effective as long the construction activity continues, but no longer than five years. If the construction continues beyond five years, the owner/operator must apply for a new permit.

44. Does the construction category only include construction of industrial buildings?

No. Any construction activity, including clearing, grading, and excavation, that results in the disturbance of five acres of land or more in total is covered by the rule. Such activities may include road building, construction of residential houses, office buildings, or industrial buildings, and demolition activity. However, this does not apply to agricultural or silvicultural activities, which are exempt from NPDES permit requirements under 40 CFR 122.4.

45. Does the rule require that storm water discharges after construction be addressed?

Yes. The individual application must describe proposed measures to control pollutants in storm water discharges that will occur after construction operations are complete, including a description of State and local erosion and sediment control specifications.

<u>Please Note</u>: EPA believes that construction activities should be covered under a storm water general permit wherever possible. 40 CFR 122.21(c)(1) allows the permitting authority to establish different and shorter submittal dates under the specific terms of a particular general permit.

46. The definition states that the operators of construction activity that disturb less than five acres are not required to apply for a permit unless that construction is part of a larger common plan of development or sale. What is meant by "part of a larger common plan of development or sale"?

"Part of a larger common plan of development or sale" is a contiguous area where multiple separate and distinct construction activities may be taking place at different times on different schedules under one plan. Thus, if a distinct construction activity has been identified onsite by the time the application would be submitted, that distinct activity should be included as part of the larger plan.

47. Who is responsible for applying for a storm water permit?

The operator is responsible for applying for the permit as required by 122.21(b). In the case of construction, the owner may submit an application for a construction activity if the operators have not yet been identified. However, once the operators have been identified, they must become either sole permittees or co-permittees with the owner. The operator is determined by who has day to day supervision and control of activities occurring at a site. In some cases, the operator may be the owner or the developer, at other sites the operator may be the general contractor.

Category xi - Light Industrial Facilities

48. If a category (xi) facility has determined that there is no exposure of certain activities or areas listed in the definition to storm water and the operator does not file a permit application, how does the operator prove, if asked, that he/she did not need to apply?

There are no requirements set forth under the November 16, 1990, rule. However, the operator may want to document the facility evaluation which led to the conclusion that there is no exposure to storm water. This documentation should be retained onsite. Some States may have specific requirements. A facility is advised to check with its NPDES permitting authority for additional requirements.

49. Do those industries listed in 122.26(b)(14)(xi) that only have access roads and rail lines exposed to storm water need to apply for a permit?

No. As stated in 122.26 (b)(14), facilities in category (xi) do not have to apply for a permit if storm water only is exposed to access roads and rail lines.

50. If air pollution control equipment vents on the roof are exposed to storm water, does this constitute exposure and trigger a permit condition?

No. The exposure of air pollution control equipment vents does not in itself constitute exposure. It is possible, however, that even with the use of air pollution control equipment, significant pollutants may be exposed to storm water. For example, if a cyclone, a common particulate control device, is used alone, only about 80 percent of the potential pollutants would be removed. 20 percent of the pollutants may then come into contact with storm water. In this case, a permit application is required.

51. If there has been past exposure, can a facility change its operation to eliminate exposure, and thus become exempt?

Yes. If a category (xi) facility can change its operation and eliminate all exposure, the facility may be exempt from the regulation. It is important to note, however, that eliminating exposure may include clean up as well.

52. Is a covered dumpster containing waste material kept outside considered exposure?

No, as long as the container is completely covered and nothing can drain out holes in bottom, or is lost in loading onto a garbage truck, this would not be considered exposure.

General Applicability

53. How is a storm water outfall from an industrial site defined for the purpose of sampling?

An industrial outfall is the point at which storm water associated with industrial activity discharges to waters of the United States or a separate storm sewer. Separate storm sewers may be roads with drainage systems, municipal streets, catch basins, curbs, gutters, ditches, man-made channels, or storm drains.

54. Are tank farms considered to be associated with industrial activity?

Yes, if they are located at a facility described in the definition of storm water discharge associated with industrial activity. Tank farms are used to store products and materials used or created by industrial facilities, and therefore are directly related to manufacturing processes. However, tank farms associated with petroleum bulk storage stations, classified as SIC code 5171, at which no vehicle maintenance or equipment cleaning operations occur, are exempt.

55. Is an offsite warehouse associated with a regulated industrial facility required to submit an application?

No. As stated on page 48011 of the preamble to the November 16, 1990, rule, warehouses of either preassembly parts or finished products that are not located at an industrial facility are not required to submit an application unless otherwise covered by the rule.

56. If a facility has more than one industrial activity, how many applications are required?

Only one application is required per facility. Permit conditions will address the various operations at the facility. The application must reflect all storm water discharges from areas associated with industrial activity as described in the definition at 122.26(b)(14). The activity in which a facility is primarily engaged determines what SIC code is assigned to that facility. To determine the activity in which a facility is primarily engaged, The SIC Manual recommends using a value of receipts or revenues approach. For example, if a facility manufactures both metal and plastic products, the facility would total receipts for each operation and the operation that generated the most revenue for the facility is the operation in which the facility is primarily engaged. If revenues and receipts are not available for a particular facility, the number of employees or production rate may be compared. If a facility performs more than two types of operations, whichever operation generates the most (not necessarily the majority) revenue or employs the most personnel, is the operation in which the facility is primarily engaged.

57. Are industrial facilities located in municipalities with fewer than 100,000 residents required to apply for a permit?

Yes. All industrial discharges of storm water through separate storm sewers or into waters of the United States must apply for an NPDES permit.

58. If the SIC code for the activity in which a facility is primarily engaged is not included in the definition of storm water discharge associated with industrial activity, but the facility has a secondary SIC code that is included in the definition, is the facility required to submit an NPDES storm water permit application?

For purposes of this regulation, a facility's SIC code is determined based on the primary activity taking place at that facility. In the case described above, the facility is not required to apply for an NPDES storm water discharge permit. However, if the facility conducts an activity on the site identified in the narrative descriptions of categories (i), (iv), (v), (vii), or (x), then the facility would be required to submit an NPDES storm water permit application for portions of the facility used for the activities described in those categories.

59. Are military bases or other Federal facilities regulated under this rule?

Yes. Industrial activities identified under 122.26(b)(14)(i)-(xi) that Federal, State, or Municipal governments own or operate are subject to the regulation.

60. Does the regulation require a permit for storm water discharges to a publicly owned treatment works?

No. A discharge to a sanitary sewer or a combined sewer system is not regulated under the storm water regulation. Storm water discharges either to waters of the United States or separate storm sewer systems require a permit if associated with any of the industrial facilities listed in 122.26(b)(i) - (xi).

61. Are there any limits or size restrictions which narrow the scope of facilities requiring an application?

The only restrictions regarding size are for construction activities and sewage treatment works. All construction activities must apply for permit coverage except for operations that disturb less than five acres of total land which are not part of a larger common plan of development or sale. Sewage treatment works designed to treat one million gallons per day or more must submit an NPDES permit application.

62. Do pilot plants or research and development facilities classified within one of the regulated SIC codes need to apply for a permit?

A pilot plant or research facility classified by an SIC code which is specified under 122.26(b)(14)(i)-(xi) would be required to submit an application. A pilot plant or research facility's operations can be directly related to the manufacturing operations of the full-scale facility and therefore warrant a permit.

63. Are stockpiles of a final product from an industrial site that are located away from the industrial plant site, included under the definition of storm water discharge associated with industrial activity?

Such stockpiles would not be covered because they are not located at the site of the industrial facility.

64. If a facility has a NPDES permit for its process wastewater and some, but not all, of its storm water discharges associated with industrial activity, does the operator need to apply?

The operator must ensure that all storm water discharges associated with industrial activity are covered by an NPDES permit. The operator may wish to submit an individual application, participate in a group application, or seek coverage under a general permit for any remaining outfalls that are not covered by an existing NPDES permit. The permitting authority may also wish to modify the existing NPDES permit to cover the other storm water discharges.

65. A facility holds a recently renewed NPDES permit which does not cover storm water discharges. Does that facility need to apply?

Yes. If the facility is identified in paragraph 122.26(b)(14)(i) through (xi) of the rule, that facility may wish to submit an individual application, participate in a group application, or seek coverage under a general permit for any remaining outfalls that are not covered by an existing NPDES permit. The permitting authority may also wish to modify or reissue the existing NPDES permit to cover the other storm water discharges.

66. If a regulated company owns and operates a subsidiary which is of a wholesale or commercial nature, would the subsidiary need to apply?

No. Since the subsidiary facility's operations are of a wholesale or commercial orientation, the operations are not considered to be industrial and therefore would not be covered by this rule unless they are specifically covered by one of the SIC codes or narrative descriptions in 122.26(b)(14).

67. Can an applicant claim confidentiality on information contained in an NPDES permit application?

No. Under 40 CFR 122.7(b), the permitting authority will deny claims of confidentiality for the name and address of any permit applicant or permittee, permit applications, permits, and effluent data.

68. Do the November 16, 1990, regulations modify the requirements of existing storm water effluent guidelines?

No. Existing storm water effluent guidelines are still applicable.

69. Which application forms are industries responsible for submitting?

- For discharges composed entirely of storm water, operators should submit Form 1 and Form 2F.

- For discharges of storm water combined with process wastewater, operators should submit Form 1, Form 2F, and Form 2C.

- For storm water discharged in combination with nonprocess wastewater, operators should submit Form 1, Form 2F, and Form 2E.

- For new sources or new discharges of storm water which will be combined with other non-storm water, operators should submit Form 1, Form 2F, and Form 2D.

70. Are Superfund sites regulated under this rule?

Yes, if the site is assigned an SIC code or fits the description of one of the categories listed in the definition of storm water discharge associated with industrial activity. Under the Superfund Amendment and Reauthorization Act (SARA) section 121(E), Superfund sites are required to "substantively comply" with all environmental regulations.

71. Are areas used for the disposal of industrial wastewaters and sanitary wastewaters included in the definition of "associated with industrial activity"?

Yes, the definition includes sites used for process water land application that are not used for agricultural activities.

72. Do inactive industrial facilities need to apply?

Yes, if the facility is included in the definition of storm water discharge associated with industrial activity and significant materials remain on site and are exposed to storm water runoff (p.48009 of 11/16/91 Federal Register). The regulation defines significant materials at 122.26 (b)(13) as including, but not limited to, raw materials; fuels; materials such as solvents, detergents, and plastic pellets; finished materials such as metallic products; raw materials used in food processing or production; hazardous substances designated under section 101(14) of the Comprehensive Environmental Response, Compensation, and Liability Act; any chemical the facility is required to report pursuant to section 313 of title III of SARA; fertilizers; pesticides; and waste products such as ashes, slag and sludge that have the potential to be released with storm water discharges.

73. Can a facility apply for an individual permit after completing the group application or applying for coverage under a general permit?

This option is available, but the operator is advised to discuss the matter directly with the permitting authority.

74. If a facility is totally enclosed with no materials or activities exposed to storm water, but has a point source discharge of storm water, is a permit application required?

If the facility is described in categories 122.26(b)(14)(i-x) a permit application is required regardless of the actual exposure of materials or activities to storm water. If the facility is described in 122.26(b)(14)(xi), a permit application is required only if there is exposure of materials or activities to storm water.

75. How does a municipally owned industrial facility apply for an NPDES permit?

Such a facility must meet the same application requirements as any other industrial facility. The facility may submit an individual permit application (Forms 1 and 2F), participate in a group application, or seek coverage under an available general permit.

76. Who is required to submit Form 1?

Anyone submitting NPDES application Forms 2C, 2D, 2E, 2F, or a construction individual application is required to submit Form 1.

77. Before the October 1, 1992, individual application deadline, which forms must a facility submit to renew its NPDES permit for a storm water discharge?

Since the individual storm water application is not due until October 1, 1992, EPA is allowing such facilities to choose whether the storm water discharges are identified on a Form 2C or a Form 2F. After October 1, 1992, a facility must submit an application in accordance with 40 CFR 122.26(c) (i.e., Forms 1 and 2F).

78. Are washwaters and/or noncontact cooling waters (e.g., air conditioner condensate) included in the definition of storm water?

No. "Storm water" means storm water runoff, snow melt runoff, and surface runoff and drainage. Washwaters are usually considered to be process wastewater. Noncontact cooling waters are considered a nonprocess wastewater.

NPDES
Storm Water Program

Question and Answer Document

Volume II

U.S. Environmental Protection Agency
Office of Wastewater Enforcement and Compliance
Permits Division
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USEFUL ACRONYMS

BAT	Best Available Technology
BCT	Best Conventional Technology
BMP	Best Management Practice
CFR	Code of Federal Regulations
CSO	Combined Sewer Overflow
CWA	Clean Water Act
CZARA	Coastal Zone Act Reauthorization Amendments
DMR	Discharge Monitoring Report
EPA	Environmental Protection Agency
EPCRA	Emergency Planning and Community Right-to-Know Act
FR	Federal Register
MS4	Municipal Separate Storm Sewer System
NOI	Notice of Intent
NOT	Notice of Termination
NPDES	National Pollutant Discharge Elimination System
NRDC	Natural Resources Defense Council
OMB	Office of Management and Budget
POTW	Publicly Owned Treatment Works
RCRA	Resource Conservation and Recovery Act
RQ	"Reportable Quantity" release
SIC	Standard Industrial Classification
TSDF	Treatment, Storage or Disposal Facility (hazardous waste)
TSS	Total Suspended Solids
WQA	Water Quality Act
WRDA	Water Resources Development Act

STORM WATER QUESTIONS AND ANSWERS PART II

I. General Applicability

1. **What kinds of storm water discharges are required to obtain an NPDES permit under Phase I of the storm water program?**

A. The National Pollutant Discharge Elimination System (NPDES) storm water permit application regulations, promulgated by the U.S. Environmental Protection Agency (EPA), require that the following storm water discharges apply for an NPDES permit: (1) a discharge associated with industrial activity; (2) a discharge from a large or medium municipal separate storm sewer system; or (3) a discharge which EPA or the State determines to contribute to a violation of a water quality standard or is a significant contributor of pollutants to waters of the United States. The permit application deadlines are specified in EPA's regulations.

2. **What is a "storm water discharge associated with industrial activity?"**

A. The term "storm water discharge associated with industrial activity" means a storm water discharge from one of the eleven categories of industrial activity defined at 40 Code of Federal Regulations (CFR) 122.26(b)(14)(i) through (xi). Five of these categories are identified by Standard Industrial Classification (SIC) code and the other six categories provide narrative descriptions of the industrial activity. The complete definition is included in Section XIII of this document.

If any activity at a facility is covered by one of the five categories which provide narrative descriptions, storm water discharges from that activity of facility are subject to storm water permit application requirements. If the primary SIC code of the facility is identified in one of the remaining six categories, the facility is subject to the storm water permit application requirements. Note that only those facilities/activities described above having <u>point source</u> discharges of storm water to waters of the United States or to a municipal separate storm sewer system or other conveyance are required to submit a storm water permit application. The definition of "point source" is provided at 40 CFR 122.2. The definition is included in Section XIII of this document.

3. **What are SIC codes and how can a facility find out its proper SIC code?**

A. SIC codes are four-digit industry codes that were created by the Office of Management and Budget (OMB) for statistical purposes. Other

governmental organizations sometimes use these codes when classifying business establishments. To find the correct SIC code, an applicant might check his or her unemployment insurance forms or contact the appropriate State unemployment services department. In addition, applicants may consult the Standard Industrial Classification Manual (SIC Manual), published by OMB in 1987. This manual is available in the resource section of most public libraries. Questions regarding assignment of particular codes can be addressed to your State permitting authority. A list of telephone numbers and addresses for State storm water contacts is provided as an attachment to this document.

4. **What SIC code should a facility use when there are multiple activities occurring at the site?**

A. For the purposes of the storm water program, a facility must determine its primary SIC code based on the primary activity occurring at the site. To determine the primary industrial activity, the SIC Manual recommends using the value of receipts or revenues. If such information is not available for a particular facility, the number of employees or production rate for each process may be compared. The operation that generates the most revenue or employs the most personnel is the operation in which the facility is primarily engaged. For case-specific determinations, contact the permitting authority for your State.

5. **How is a facility regulated when multiple activities conducted by different operators are occurring on the same site (airports, for example)?**

A. When multiple activities are conducted by different operators at a single location, each industrial activity is assigned its own SIC code. At an airport, for example, a passenger airline carrier will receive one SIC code, but an overnight courier located in the same hanger may receive another SIC code. Whereas the SIC codes may differ, if both are regulated industrial activities, EPA generally encourages these operators to become co-applicants (submit storm water permit application forms together) when they are located at the same site and when industrial areas/drainage basins are shared. When a permit is issued (or if the operators are filing for a general permit) the co-applicants will become co-permittees and share responsibility of permit compliance.

6. **If a facility's primary SIC code is not listed in the regulations, but an activity that occurs on site is described in one of the narrative categories of industrial activity, does that facility have to apply for a permit?**

A. If a facility conducts an activity on the site identified in the narrative descriptions of categories (i), (iv), (v), (vii), (ix) or (x), then the facility would be required to submit a storm water permit application for discharges from those portions of the facility where the activity occurs. Such narrative activities/facilities include: (i) activities subject to storm water effluent limitations guidelines, new source performance standards, or toxic pollutant effluent standards; (iv) hazardous waste treatment storage, or disposal facilities including those that are operating under interim status or a permit under subtitle C of the Resource Conservation and Recovery Act (RCRA); (v) landfills, land application sites and open dumps that receive or have received industrial wastes; (vii) steam electric power generating facilities; (ix) sewage treatment works with a design flow of 1.0 mgd or more; and (x) construction activity disturbing five or more acres of land.

7. **Do storm water discharges from non-industrial areas at an industrial facility (employee parking lots, rental car operations at an airport) have to be addressed in an NPDES permit?**

A. No. Only storm water discharges from those areas that are associated with industrial activity, as defined at 40 CFR 122.26(b)(14) must be addressed in the permit. However, if storm water runoff from a non-industrial area commingles with runoff from a regulated industrial area, the combined discharge would require permit coverage.

8. **How are off site facilities (such as distribution centers, storage facilities, vehicle maintenance shops) regulated under the storm water program?**

A. To determine the regulatory status of off site facilities, first the operator of a facility must determine if that off site operation can be classified according to its own SIC code. If there is no SIC code which describes the off site facility independently, then it would assume the SIC code of the parent facility it supports. However, certain off site facilities that fall within the categories of auxiliary facilities described in Section XIV of this document (or which are specifically described in the SIC code description) would, in most cases, be classified according to the parent facility they support. Such supporting establishments include central administrative offices, research and development laboratories, maintenance garages, and local trucking terminals.

EPA has determined that off site vehicle maintenance facilities that service trucks used for local transportation of goods or for local services are generally considered supporting establishments which would not be assigned a transportation SIC code; rather, such facilities are classified

according to the SIC code of the facility they support. Please refer to Section II of this document for a discussion of off-site vehicle maintenance facilities.

9. **Can authorized NPDES States be more expansive in their use of the assignment of SIC codes? For example, can they make the rule applicable to secondary activities?**

A. Yes, State storm water regulations can be more expansive and cover more activities than the Federal regulations.

10. **Are all storm water discharges to sanitary sewers exempt from storm water permitting requirements? What about discharges to combined sewer systems?**

A. Any storm water discharge to a Publicly Owned Treatment Works (POTW) or to a sanitary sewer is exempt from storm water permit application requirements. However, it may be subject to EPA's pretreatment program under Section 307(b) of the CWA. Discharges to combined sewer systems are also exempt from NPDES permitting but may be subject to pretreatment requirements.

11. **Is a storm water permit application required for an industrial facility that has constructed a holding pond that usually does not discharge storm water, but could in the event of a large enough storm?**

A. All point source discharges of storm water associated with industrial activity that discharge to waters of the U.S. or through a municipal separate storm sewer system must be permitted. Therefore, if an industrial facility does not have a storm water discharge from its holding pond during typical storm events but has a storm water discharge in the event of a large storm, that discharge must be covered under an NPDES permit. In NPDES authorized States (a list is provided in Section XII of this document), facilities should consult their permitting authority for State-specific determinations on such "potential discharges."

12. **If a facility is <u>not</u> engaged in industrial activity as defined under 40 CFR 122.26(b)(14)(i)-(xi), but discharges contaminated flows comprised entirely of storm water into a nearby municipal separate storm sewer system, is the facility required to obtain a storm water permit?**

A. No, unless EPA or the State designates the discharge as contributing to a violation of a water quality standard or as significantly contributing pollutants to waters of the United States. However, industrial dischargers

should note that large and medium municipalities (population 100,000 or more) are currently designing storm water management programs that will control contaminated storm water discharges from entering their separate storm sewer systems. Additional storm water discharges may be regulated under Phase II of the storm water program. EPA is currently in the process of developing Phase II.

13. **Are activities associated with industrial activity that occur on agricultural lands exempted from storm water permitting requirements?**

A. No. If a storm water discharge is associated with industrial activity as defined at 40 CFR 122.26(b)(14), it is subject to permit application requirements regardless of the location of the industrial activity. For example, if a gravel extraction activity occurred on land leased from a farm, the activity would be classified as mining under SIC code 1442 or 1446 and therefore would be considered a storm water discharge associated with industrial activity and require a permit.

14. **Are NPDES permits transferable from one facility owner to the next?**

A. Individual NPDES permits may be transferred to a new owner or operator if the permit is modified. These procedures are described at 40 CFR 122.61. Under the general permits for storm water discharges, issued by EPA in the September 9, 1992 and September 25, 1992, Federal Register notices (57 FR 41176 and 57 FR 44412), the new operator can submit an NOI two days prior to the change of ownership but must include the facility's existing general permit number on the NOI form. Many NPDES authorized States have similar provisions in their general permits.

15. **How does storm water permitting differ in States with approved State NPDES programs compared to States without NPDES State permit programs?**

A. While Federal storm water regulations (i.e., the November 16, 1990, storm water permit application regulations) establish minimum requirements nationwide. State permitting authorities may impose more stringent requirements or decide to expand the scope of its program to meet State priorities. EPA Regional offices are the permitting authorities for 12 States and most Territories; the remaining 38 States and the Virgin Islands administer their own storm water programs and issue permits to regulate municipalities and industries in their States. Regulated facilities in these States should contact the appropriate State permitting authority for guidance, application forms, general permits and other materials. Please

note that some of the NPDES States do not issue permits for Federal facilities located in their States.

For regulated facilities in the 12 non-delegated States (MA, NH, ME, FL, TX, OK, LA, NM, SD, AZ, AK, ID), the Territories (all except the Virgin Islands), the District of Columbia, and for facilities located on Indian lands (in most, if not all, delegated States and in all non-delegated States), and for Federal facilities in the States of DE, CO, IA, KS, NH, NY, OH, SC, VT and WA, the storm water program is administered through EPA Regional offices. Such facilities may be eligible for coverage under the general permits issued by EPA in the September 9, 1992, and September 25, 1992, Federal Register notices (57 FR 41176 and 57 FR 44412).

II. Definition of Storm Water Discharge Associated With Industrial Activity

Category (i): Facilities subject to storm water effluent limitations guidelines, new source performance standards or toxic pollutant effluent standards under 40 CFR subchapter N.

16. What are toxic pollutant effluent standards?

A. 40 CFR 122.26(b)(14)(i) includes facilities that are subject to storm water effluent limitations guidelines, new source performance standards, or toxic pollutant effluent standards. The phrase "toxic pollutant effluent standards" refers to the standards established pursuant to CWA section 307(a)(2) and codified at 40 CFR Part 129. Part 129 applies only to manufacturers of six specific pesticide products which are defined as toxic pollutants. Please note that the phrase "facilities subject to toxic pollutant effluent standards" does not refer to those industries subject to effluent limitation guidelines for toxics under 40 CFR subchapter N.

Category (iii): Mining and oil and gas operations classified as SIC codes 10-14.

17. What constitutes "contamination" at an oil and gas facility?

A. Oil and gas facilities classified as SIC code 13 are required to apply for a storm water permit if the facility has had a release of a Reportable Quantity (RQ) in storm water for which notification has been required any time since November 16, 1987, or if the discharge contributes to a

violation of a water quality standard. RQs for which notification is required are defined at 40 CFR Parts 110, 117, and 302. An RQ for oil is defined at 40 CFR 110 as the amount of oil that violates applicable water quality standards or causes a film or sheen upon or a discoloration of the water surface or adjoining shorelines, or causes a sludge or emulsion to be deposited beneath the water surface or upon adjoining shorelines. For other substances, RQ levels are expressed in terms of pounds released over any 24 hour period and are listed at 40 CFR 117.3 and 40 CFR 302.4. A list of these RQ levels is available from the Storm Water Hotline at (703) 821-4823.

18. **Do EPA's industrial storm water general permits apply to discharges from mine sites that are subject to storm water effluent limitations guidelines, but which are not covered by an existing NPDES permit?**

A. No, storm water discharges from mine sites that are subject to storm water effluent limitation guidelines are not authorized by industrial storm water general permits issued by EPA in the September 9, 1992, and September 25, 1992, Federal Register notices (57 FR 41176 and 57 FR 44412). In States without NPDES permitting authority, the mine operators submit an individual application to address those storm water discharges, or could have participated in a group application prior to October 1, 1992 (note: any facility which did not submit an individual application prior to October 1, 1992 or participate in a timely group application missed EPA's regulatory deadline and may be subject to enforcement action). However, certain authorized States may issue general permits authorizing such storm water discharges from mine sites provided that those permits contain the applicable guideline requirements.

19. **Can point source discharges of contaminated ground water from mine adits and seeps at active or inactive mine sites be permitted under the storm water program?**

Point source discharges of non-storm water to waters of the United States must be authorized by an NPDES permit. Point source discharges of either contaminated ground water from a mine adit or seep that are not related to specific storm events would not be considered to be storm water. Discharges that are composed in whole or in part of non-storm water cannot be addressed solely by the permit applications for storm water (Forms 1 and 2F), and cannot be authorized by NPDES permits that only authorize discharges composed entirely of storm water. Rather, Forms 1 and 2C or 2D (and Form 2F if the discharge is mixed with storm water) must be used when applying for a NPDES permit for non-storm water.

Category (iv): Hazardous waste treatment, storage or disposal facilities.

20. **If the primary SIC code of a facility is not covered under the regulations, but there is a hazardous waste treatment, storage or disposal facility (TSDF) on site, is the TSDF subject to storm water permitting requirements?**

A. Yes. If the hazardous waste TSDF is or should be operating under interim status or a permit under Subtitle C of the Resource Conservation and Recovery Act (RCRA), regardless of the facility's primary activity, the storm water discharges from that portion of the site are subject to the narrative definition of storm water discharges associated with industrial activity under category (iv). Even if a facility's SIC code is not included in the regulations, any activity described by one of the narrative categories of "industrial activity" that is occurring on the site would be regulated under the storm water program.

Category (v): Landfills, land application sites and open dumps that receive industrial waste.

21. **At what point does an inactive, closed, or capped landfill cease being an industrial activity?**

A. An inactive, closed or capped landfill is no longer subject to storm water permit application requirements when the permitting authority determines the land use has been altered such that there is no exposure of significant materials to storm water at the site. For example, if an impervious surface (such as a parking lot or shopping center) now covers the closed landfill, the permitting authority could determine that storm water discharges from the area are no longer associated with the previous landfill activity. These determinations must be made by the permitting authority on a case-by-case basis.

22. **If construction of cells at a landfill disturbs greater than five acres of land, is coverage under EPA's construction general permits required?**

A. No. EPA considers construction of new cells to be routine landfill operations that are covered by the landfill's industrial storm water general permit. However, the storm water pollution prevention plan for the landfill must incorporate best management practices (BMPs) that address sediment and erosion control. Where a new landfill is being constructed

and five or more acres of land are being disturbed, such activity would need to be covered under EPA's construction general permit until the time that initial construction is completed and industrial waste is received. Please note that NPDES authorized States may address this situation differently.

Category (viii): Transportation facilities

23. **If all vehicle maintenance and equipment cleaning operations occur indoors at a transportation facility, as defined at 40 CFR 122.26(b)(14)(viii), is a permit application required for discharges from the roofs of these buildings?**

A. Yes. Storm water discharges from all areas that are "associated with industrial activity," described at 40 CFR 122.26(b)(14), are subject to the storm water permit application requirements. This would include discharges from roofs of buildings that are within areas associated with industrial activity. In addition, storage areas of materials used in vehicle maintenance or equipment cleaning operations and holding yards or parking lots used to store vehicles awaiting maintenance are also considered areas associated with industrial activity.

24. **For a facility classified as SIC code 5171 (bulk petroleum storage), is the transfer of petroleum product from the storage tanks to the distribution truck considered "fueling", and therefore an industrial activity as defined by the regulations?**

A. No. The transfer of petroleum product from the storage tanks to the tanker truck is not considered fueling and would not require a storm water permit. However, fueling of the tanker truck itself at the 5171 facility is considered to be part of routine vehicle maintenance, and storm water discharges from these areas must be covered under a storm water permit application.

25. **Is a retail fueling operation that occurs at an SIC code 5171 petroleum bulk storage facility regulated?**

A. No. The provisions of 40 CFR 122.26(b)(14)(viii) apply to fueling operations conducted at petroleum bulk storage facilities where the vehicles being fueled are involved with the petroleum bulk storage operation. Retail fueling of vehicles at such sites does not constitute "vehicle maintenance" (as defined in the November 16, 1990 Federal

Register page 48066), and a storm water permit is not required for the discharges from that area. Only those portions of the SIC code 5171 facility where vehicle maintenance operations (including vehicle rehabilitation, mechanical repairs, painting, fueling, and lubrication) and equipment cleaning take place are required to be covered under a storm water permit application.

26. **Are off site vehicle maintenance areas required to submit permit applications for their storm water discharges?**

A. As discussed in Section I of this document, to determine the regulatory status of off site vehicle maintenance operations, the operator of a facility must first determine if that off site operation can be classified according to its own SIC code. If there is no SIC code which describes the off site facility independently, then it would assume the SIC code of the parent facility it supports. However, please note that off-site facilities that fall within the nine categories listed on page 17 of the SIC Manual (or which are specifically described in the SIC code description) would, in most cases, be classified according to the parent facility they support. See Section XIII of this document for the complete list. Such supporting establishments include central administrative offices, research and development laboratories, maintenance garages, and local trucking terminals. EPA has determined that off site vehicle maintenance facilities that primarily service trucks used for local transportation of goods or for local services are generally considered supporting establishments which do not assume a transportation SIC code; rather, such facilities are classified according to the SIC code of the facility they support. Long-distance trucking centers, on the other hand, are generally classified as SIC code 4213, and are subject to regulation under 40 CFR 122.26(b)(14)(viii)).

Category (x): Construction activity

27. **Who must apply for permit coverage for construction activities?**

A. Under the NPDES storm water program, the operator of a regulated activity or discharge must apply for a storm water permit. EPA clarified that the operator of a construction activity is the party or parties that either individually or taken together meet the following two criteria: (1) they have operational control over the site specifications (including the ability to make modifications in specifications); and (2) they have the day-to-day operational control of those activities at the site necessary to ensure compliance with plan requirements and permit conditions (9/9/92 Federal Register page 41190). If more than one party meets the above criteria,

then each party involved must become a co-permittee with any other operator(s). For example, if the site owner has operational control over site specifications and a general contractor has day-to-day operational control of site activities, then both parties will be co-permittees.

When two or more parties meet EPA's definition of operator, each operator must submit an NOI, and either include a photocopy of the other operators' NOI(s) or the general permit number that was assigned for that project. Under EPA's storm water construction general permits, the co-permittees are expected to join in implementing a common pollution prevention plan prior to submittal of the NOI, and in the retention of all plans and reports required by the permit for a period of at least three years from the date that the site is finally stabilized.

For individual storm water discharge permits, applications must be filed 90 days prior to the commencement of construction. If a contractor has not been selected at the time of application, the owner of the project site would initially file the application and the contractor should sign on when selected. Under an individual storm water permit for construction, multiple operators would have to sign onto the permit, instead of submitting a new application. Please note that authorized NPDES States may have varying NOI and/or permit requirements and should be contacted on this issue.

28. What are the responsibilities of subcontractors at the construction site under EPA's storm water construction general permits?

A. EPA storm water construction general permits require subcontractors to implement the measures stated in the pollution prevention plan and to certify that he/she understands the terms and conditions of the permit requirements. Under EPA's general permits, subcontractors are not required to submit NOIs.

29. What is meant by a "larger common plan of development or sale?"

A. A "larger common plan of development or sale" is a contiguous area where multiple separate and distinct construction activities may be taking place at different times on different schedules under one plan. For example, if a developer buys a 20-acre lot and builds roads, installs pipes, and runs electricity with the intention of constructing homes or other structures sometime in the future, this would be considered a common plan of development or sale. If the land is parceled off or sold, and construction occurs on plots that are less than five acres by separate, independent builders, this activity still would be subject to storm water permitting requirements if the smaller plots were included on the original site plan.

30. **Does construction activity encompass repaving of roads?**

A. Repaving is not regulated under the storm water program unless five or more acres of underlying and/or surrounding soil are cleared, graded or excavated as part of the repaving operation.

31. **Is clearing of lands specifically for agricultural purposes regulated construction activity (40 CFR 122.26(b)(14)(x)) under the storm water program?**

A. No. Although the clearing of land may be greater than five acres, any amount of clearing for agricultural purposes is not considered an industrial activity under the storm water regulations. Section 402(l)(1) of the 1987 Water Quality Act exempts agricultural storm water discharges from NPDES permitting requirements including storm water permitting. This exemption only applies, however, if the clearing of land is solely for agricultural purposes. (See Question 13).

32. **If a construction activity that disturbs five or more acres commences on a site covered by an existing industrial storm water permit, are the storm water discharges from the construction area covered by the existing permit or is a separate permit required?**

A. If the existing permit is an individual permit, then the operator must either request a modification of the existing permit to include the construction storm water discharges or apply for coverage under a separate permit that specifically addresses that construction activity. If the permittee decides to modify the existing individual permit, permit modifications must be approved prior to initiating any construction activity. If the existing permit is an EPA storm water industrial general permit, the operator should submit an NOI for coverage under EPA's storm water general permit for construction activities. States with NPDES permitting authority may have different requirements.

33. **If a construction activity that disturbs less than five acres occurs on site of a regulated industrial activity currently covered by EPA's industrial storm water general permit, does the regulated industry have to modify its pollution prevention plan to include controls for the area of construction?**

A. Yes. Regulated industrial activities covered by EPA's storm water industrial general permit must revise their pollution prevention plan to address all new sources of pollution and runoff including those from construction activities disturbing less than five acres, that occurred on the site of the regulated industry. However, if less than five acres, a separate

storm water permit for the construction activity is not required (see Question 32).

34. **For projects such as a 100-mile highway construction project, what location should be provided on the NOI?**

A. The midpoint of a linear construction project should be used as the site location on EPA's NOI form. For construction projects that span across more than one State, the project must meet the application requirements of each State.

35. **Are long-term maintenance programs for flood control channels (such as vegetation removal) or similar roadside maintenance programs subject to permitting if five or more acres are disturbed?**

A. If grading, clearing or excavation activities disturb five or more acres of land either for an individual project or as part of a long-term maintenance plan, then the activity is subject to storm water permit application requirements.

36. **For a construction activity that uses off site "borrow pits" for excavation of fill material or sand and gravel, should the number of disturbed acres at the borrow pit be added to the number of acres at the construction site to determine the total number of disturbed acres?**

A. No, off site borrow pits are not considered part of the on site construction activity. If a borrow pit is specifically used for the removal of materials such as sand, gravel, and clay, the pit is considered a mine and is classified under SIC code 14. Such sites would be regulated as industrial activity as defined at 40 CFR 122.26(b)(14)(iii). However, if the borrow pit is utilized for the removal of general fill material (e.g. dirt) and disturbs five or more acres of land, the pit would be considered a construction activity as defined at 40 CFR 122.26(b)(14)(x).

37. **Would building demolition constitute a land disturbing activity and require a storm water construction permit application?**

A. The definition of land disturbing activity includes but is not limited to clearing, grading and excavation. At a demolition site, disturbed areas might include the site where building materials, demolition equipment, or disturbed soil are situated, which may alter the surface of the land. Therefore, demolition activities that disturb five or more acres of land would be subject to storm water construction permit application requirements.

38. **What are the legal responsibilities and liabilities for construction activities disturbing less than five acres, pursuant to the Ninth Circuit U.S. Court of Appeals decision on June 4, 1992?**

A. In NRDC v. EPA, 966 F.2d 1292, the Ninth Circuit U.S. Court of Appeals remanded for further rulemaking, EPA's exemption of construction sites less than five acres which are not part of a larger common plan of development or sale. The Agency intends to undergo further rulemaking proceedings for construction sites less than five acres. Until further rulemaking is completed, permit applications for such activities need not be submitted to EPA. However, States with NPDES permitting authority may have more stringent requirements.

39. **Do storm water construction general permits authorize non-storm water discharges?**

A. Under EPA's storm water construction general permits, issued on September 9, 1992, and September 25, 1992, the following non-storm water discharges are conditionally authorized (57 FR 41219) and (57 FR 44419): discharges from fire fighting activities; fire hydrant flushings; waters used to wash vehicles or control dust; potable water sources including waterline flushings; irrigation drainage; routine external building washdown which does not use detergents; pavement washwaters where spills or leaks of toxic or hazardous materials have not occurred (unless all spilled material has been removed) and where detergents are not used; air conditioning condensate; springs; uncontaminated ground water; and foundation or footing drains where flows are not contaminated with process materials such as solvents. These discharges, except for flows from fire fighting activities, must be identified in the pollution prevention plan and the plan must address the appropriate measures for controlling the identified non-storm water discharges. Other non-storm water discharges not listed above or not identified in the storm water pollution prevention plan, must be covered by a different NPDES permit.

Category (xi): Light manufacturing facilities

40. **If oil drums or contained materials are exposed during loading or unloading at a category (xi) facility, are storm water discharges from this area subject to the storm water regulations?**

A. The storm water regulations require category (xi) facilities to apply for a storm water permit where material handling equipment or activities, raw materials, intermediate products, final products, waste materials, by-products, or industrial machinery are exposed to storm water. If there is a

reasonable potential for leaks or spills from these drums which could be exposed to storm water, discharges from that area would be subject to storm water permitting requirements. Completely covering loading and unloading activities may eliminate exposure. Note that permitting authorities may have more stringent interpretations with respect to exposure on industrial sites and should be consulted for case-by-case determinations. For a discussion on the 9th Circuit Court of Appeals decision (June 1992) and future EPA rulemakings on category (xi) facilities, please refer to Section IX of this document.

41. **Does the storage of materials under a roof at a category (xi) facility constitute exposure?**

A. If materials or products at a light industrial facility are stored outside under a roof and there is no reasonable potential for wind blown rain, snow, or runoff coming into contact with the materials or product, then there may not be exposure at that area. However, if materials are stored under a structure without sides and storm water comes into contact with material handling equipment or activities, raw materials, intermediate products, final products, waste materials, by-products or industrial machinery, the discharge from that area must be permitted. The permitting authority should be contacted for specific issues related to exposure.

III. Individual Permits

42. **Will individual permits include requirements for storm water pollution prevention plans and monitoring?**

A. EPA anticipates that many individual permits will include storm water pollution prevention plans as a means of satisfying Best Available Technology (BAT)/Best Conventional Technology (BCT) requirements established in the Clean Water Act (CWA). With regard to monitoring requirements under individual permits, such requirements will be determined by the permit writer on a case-by-case basis. At a minimum, all facilities with storm water discharges associated with industrial activity must conduct an annual site inspection as prescribed at 40 CFR 122.44(i)(4).

43. **Do permitting authorities have the option of subjecting facilities that have submitted individual storm water permit applications to general permits?**

A. Yes, permitting authorities may subject facilities that have submitted individual permit applications to general permits. Facilities that are covered

by a general permit may petition the permitting authority to be covered under an individual permit by submitting an individual permit application with reasons supporting the request to the permitting authority, pursuant to 40 CFR 122.28(b)(2)(iii).

44. **What are the benefits/drawbacks of pursuing an individual storm water permit over a general permit?**

A. An individual storm water permit may be advantageous, as it is designed to reflect a facility's site-specific conditions, whereas general permits are much broader in scope, particularly in terms of monitoring requirements. However, the individual permit application is generally more difficult to prepare than submitting EPA's notice of intent (NOI) to be covered under a general permit (in part because the individual permit application requires sampling and EPA's NOI does not). General permits may be advantageous because regulated facilities know, in advance of submitting their NOI, the requirements of the permit. In addition, coverage under a general permit may be automatic (depending on how the permit is written), whereas the individual permitting process takes longer.

45. **When does EPA anticipate that individual permits will be issued?**

A. Issuance of individual permits may vary on a State by State basis, as permitting priorities and resources allow. The December 18, 1992, Federal Register (57 FR 60447) established October 1, 1993, as the deadline by which individual permits are to be issued. Many authorized States are already issuing individual permits.

46. **Can a facility that has submitted an individual permit application obtain general permit coverage upon issuance of a general permit in its State?**

A. Yes, an eligible facility may opt for coverage under a general permit (by submitting an NOI) up until the time that the permitting authority issues such facility its individual permit. Authorized States may require a written request for withdrawal from the individual permit application process. EPA recommends submitting such requests to the appropriate Regional office.

IV. EPA General Permits (issued on 9/9/92 and 9/25/92)

47. What is the difference between EPA's construction and industrial general permits?

A. Because the nature of construction activity varies considerably from other industrial activities, EPA developed two separate general permits: one covering storm water discharges from construction activity and one for other storm water industrial discharges. Whereas the pollution prevention plan for the construction permit focuses on sediment and erosion controls and storm water management, the pollution prevention plan for industry emphasizes general site management. Note that some authorized States have industrial general permits that authorize storm water discharges from construction activity.

EPA's general permits for storm water discharges associated with industrial activity, issued on 9/9/92 (57 FR 41236) and 9/25/92 (57 FR 44438), authorize storm water discharges from all new and existing point source discharges of storm water associated with industrial activity, as defined at 40 CFR 122.26(b)(14), to waters of the U.S., except for ineligible storm water discharges that are listed at I.B.3. (9/9/92 Federal Register page 41305) and
(9/25/92 Federal Register page 44444) in EPA's general permits.

EPA's general permits for storm water discharges associated with construction activity, which were issued on 9/9/92 (57 FR 41176) and 9/25/92 (57 FR 44412), authorize storm water discharges associated with construction activity, as defined at 40 CFR 122.26(b)(14)(x), except for ineligible discharges that are listed at I.B.3 (9/9/92 Federal Register page 41217) and (9/25/92 Federal Register page 44418) in EPA's general permits.

48. What is the procedure for applying for coverage under EPA's industrial or construction general permits?

A. Dischargers of storm water associated with industrial activity located in non-NPDES States must submit a Notice of Intent (NOI) to be authorized to discharge under the general permit. The NOI form is a one-page document requesting basic information about the nature of the facility and the particular storm water discharge under consideration. Under EPA's general permits, monitoring is not required for submittal of the NOI. States with NPDES authority may have different requirements for their NOI and should be contacted directly.

49. **Will a facility automatically be covered by an EPA general permit upon submittal of an NOI or will it have to cease operations until the Agency provides notification of acceptance?**

A. Permit coverage begins two days after the postmark date on the NOI, provided the storm water discharges from the facility are eligible for coverage as established by the permit conditions (see 9/9/92 Federal Register page 41305 for limitations on coverage). The permitting authority can require the submittal of an individual application at any time. However, the facility may continue to discharge under the general permit until an individual permit is issued or denied.

50. **What are the deadlines for compliance with EPA's general permits?**

A. Individuals who intend to obtain coverage for a storm water discharge associated with industrial activity that commenced on or before October 1, 1992, were required to submit an NOI by October 1, 1992; however, EPA is accepting late NOIs. Regulated facilities wishing to obtain coverage under the general permit that have not yet submitted an NOI should do so immediately. EPA's storm water general permits require permittees to develop and implement a storm water pollution prevention plan. Deadlines for NOI submittal and development and implementation of plans are listed in the table below.

Facilities with salt storage or facilities that were not required to report under Emergency Planning Community Right to Know (EPCRA) Section 313 prior to July 1, 1992, (but must report after that date) must comply with the special requirements for section 313 facilities and salt storage (if applicable) within 3 years of the date on which the facility is required to first report under section 313. All other conditions in the permit must be met within the deadlines listed above. Plans do not have to be submitted to the Agency but must be kept on site and made available upon request.

Type of Discharge	NOI Deadline	Pollution Prevention Plan Development Deadline	Pollution Prevention Plan Implementation Deadline
Existing industrial activities (other than construction)	October 1, 1992	April 1, 1993	October 1, 1993

Type of Discharge	NOI Deadline	Pollution Prevention Plan Development Deadline	Pollution Prevention Plan Implementation Deadline
Industrial activities (other than construction) that begin between October 1, 1992 and January 1, 1993	2 days prior to the start of industrial activity	Within 60 days of commencement of operations	Within 60 days of commencement of operations
Industrial activities (other than construction) that begin on or after January 1, 1993	2 days prior to the start of industrial activity	Within 60 days of commencement of operations	Upon commencement of operations
Oil and gas facilities previously not required to be permitted that have an RQ after October 1, 1992	Within 14 days of first knowledge of the release	Within 60 days of first knowledge of the release	Within 60 days of first knowledge of the release
Municipally-owned or operated industrial activities that were rejected or denied from a group application	Within 180 days of the date of rejection or denial	Within 365 days of the date of rejection or denial	Within 545 days of the date of rejection or denial
Construction sites in operation on October 1, 1992	October 1, 1992	October 1, 1992	October 1, 1992
Construction sites that begin operation after October 1, 1992	2 days prior to the start of construction	Prior to the submittal of the NOI	With the initiation of construction activities

51. Is there a fee for NOI applications?

A. EPA's general permits do not require fees at this time. However, authorized NPDES States may levy fees and should be contacted directly.

52. Where should NOIs be submitted?

A. Facilities in States and Territories where EPA is the permitting authority submit NOIs to the central processing center at the following address:

Storm Water Notice of Intent
P.O. Box 1215
Newington, VA 22122.

All permittees in States with NPDES authority submit the NOI to their State permitting authority except those in New York, who submit to the processing center at the above address. Note that authorized NPDES States may develop NOI forms that are different from EPA's NOI form. Under EPA's general permits, the operator of any industrial activity that discharges storm water through a municipal separate storm sewer system in a medium or large municipality must also submit a copy of the NOI to that municipality. In addition, operators of construction activities must provide a copy of all applicable NOIs for a site to the local agency approving sediment and erosion plans or storm water management plans.

53. Is an operating regulated industrial facility required to submit a separate NOI for each outfall that discharges storm water associated with industrial activity at the site?

A. Under EPA's general permits, one NOI is generally sufficient for the entire site, provided there is one operator. In this case, the pollution prevention plan must address all discharges of storm water associated with industrial activity from the site. If there are multiple operators at the site, each operator must submit an NOI. In addition, if a facility that is covered under EPA's industrial storm water general permit undertakes a construction activity disturbing more than five acres of land, then the facility must submit an NOI for those construction-related storm water discharges for coverage under EPA's construction general permit (or submit an individual permit application).

54. Will a facility receive any notification from EPA after submitting an NOI under EPA's general permit?

A. Yes, EPA confirms the receipt of NOIs and will provide the applicant with a permit number and explains how to get a summary of the guidance on preparing storm water pollution prevention plans.

55. Is an entire facility excluded from coverage under EPA's general permits if a single discharge at the site is excluded from coverage?

A. No. Eligibility under EPA's general permits should be applied on a discharge-specific basis. Thus, a site with multiple discharges can be covered under two different permits: a general permit for some discharges and a separate NPDES permit for any discharges excluded from coverage under the general permit. NPDES States should be contacted for additional guidance on this issue.

56. Does an industrial facility operating under an EPA industrial general permit have to apply for a separate permit for all on site construction activities that disturb more than five acres of land?

A. Storm water discharges from construction activities that disturb five or more acres of land must be covered under a separate NPDES permit that specifically addresses storm water discharges from construction activity. EPA's industrial storm water general permits do not provide coverage for storm water discharges from regulated construction activities. Construction activities that disturb less than five acres of land do not require a storm water permit at this time. The pollution prevention plan for the industrial facility must be modified to address site changes due to that amount of construction activity.

57. Can a facility submit one NOI for similar but separately located industrial facilities which are owned by the same corporation?

A. No. One NOI must be submitted by the operator of each individual facility that intends to obtain coverage under a general permit, regardless of common ownership.

58. Does an asphalt/concrete batch plant have to submit a new NOI each time it changes location?

A. Under EPA's general permits, an NOI must be submitted each time the plant moves to a new site of operation. However, some authorized States may have different requirements with respect to asphalt/concrete batch

plants and, therefore, facilities in such States should contact their permitting authorities.

59. **Who is required to monitor under the conditions of EPA's storm water general permits?**

A. EPA established tiered monitoring requirements in its final industrial storm water general permits based on the potential to contribute pollutants to storm water (4/2/92 Federal Register page 11394). Six classes of facilities are required to monitor semiannually and report annually, ten classes of facilities are required to monitor annually and keep the data on site, and all other classes of facilities are not required to monitor. All facilities authorized by general permits (including those facilities not otherwise required to monitor) must still conduct an annual site inspection, except for inactive mining sites where this may be impractical due to remote location and inaccessibility of sites (inspection no less than once in three years). The sixteen classes of facilities that are required to monitor are specified in EPA's industrial general permits (9/9/92 Federal Register page 41248), which are available from the Storm Water Hotline. EPA's construction storm water general permits require periodic inspections in lieu of monitoring.

60. **If an industrial facility that is required to monitor under EPA's industrial storm water general permits does not have any exposure of materials or activities to storm water, does it still have to conduct sampling?**

A. Under EPA's industrial storm water general permits, industrial facilities can provide a certification in lieu of monitoring results for a given outfall, that materials and activities are not presently exposed to storm water and will not be exposed during the certification period (see 9/9/92 Federal Register page 41314 for a more detailed description). This determination should be applied on outfall-by-outfall basis (e.g., permittees may elect to monitor certain outfalls while providing certification for others). The certification must be updated on an annual basis and retained in the pollution prevention plan. The six classes of facilities that are required to report monitoring results annually must submit this certification to the permitting authority in lieu of the Discharge Monitoring Report (DMR).

61. **Within one drainage area leading to a single outfall, if a facility conducts two separate industrial activities that are subject to both semiannual and annual monitoring requirements, which set of monitoring requirements will apply?**

A. If the discharges cannot be segregated, the combined discharge would be subject to both sets of monitoring requirements. In effect, a combined

discharge could be subject to annual monitoring requirements for certain parameters and semi-annual monitoring for others. If a facility can segregate the discharges from the different activities, separate monitoring requirements would apply to each discharge.

62. **Is it possible to sample only one of several identical outfalls under the provisions of EPA's general permits?**

Yes. To reduce the monitoring burden on the facility, the permit allows an operator to sample one outfall where it is substantially identical to the other outfalls. Permittees that intend to use this provision must justify and document in writing why one outfall is substantially identical to the others. Criteria for making this determination are presented in the NPDES Storm Water Sampling Guidance Document. Facilities using this provision must include the written justification in their storm water pollution prevention plan. Facilities that are subject to semiannual monitoring requirements must submit the justification of why an outfall is substantially identical to the others with the Discharge Monitoring Report. Other facilities required to monitor under the permit are not required to submit the justification unless it is requested by the permitting authority.

63. **If a facility had to report under section 313 of the Emergency Planning and Community Right to Know Act (EPCRA) when its NOI was submitted but no longer uses the quantity of water priority chemicals that makes such reporting necessary, is that facility still subject to special requirements in EPA's industrial storm water general permits for facilities that handle EPCRA section 313 water priority chemicals?**

A. No. Such facilities are no longer subject to the special EPCRA requirements contained in EPA's industrial storm water general permit and should accordingly modify their pollution prevention plan to indicate the changes in industrial activity at the facility.

64. **Under EPA's general permits, when and where must Discharge Monitoring Reports (DMR) be submitted for semi-annual monitoring facilities?**

A. DMRs must be submitted to the permitting authority according to the following schedule: a) certain EPCRA section 313 facilities and wood treatment facilities monitor from January to June and July to December and report no later than January 28 following the second monitoring period; b) Primary metal facilities, facilities with coal pile runoff, and battery reclaimers monitor from March to August and September to February and report no later than April 28; and c) land disposal facilities monitor from October to March and from April to September and report no later than October 28. For facilities in non-NPDES States, DMRs must be

submitted to the EPA Regional office (Section XI of this document includes storm water list of contacts for addresses). In States with approved NPDES permit programs, DMRs must be sent to the location specified in the State's general permit. The general permits in such States may also have different schedules for submitting DMRs than the one specified above.

65. **Under the industrial general permit, coal-fired steam electric facilities have annual monitoring requirements for storm water discharges from coal handling sites (other than from coal pile runoff). Are access roads considered coal handling sites?**

A. Coal handling sites include those areas of the facility where coal is either loaded or unloaded. Therefore, those portions of access roads where loading/unloading operations do not occur are not considered to be coal handling sites and, therefore, are not subject to annual monitoring requirements under EPA's general permits.

66. **Are there specific numeric effluent limits in EPA's storm water general permits?**

A. EPA's general permits establish pollutant discharge limits for total suspended solids (TSS) and pH in coal pile runoff. In most other situations, EPA's industrial storm water general permits focus on storm water management and the implementation of facility-specific pollution prevention plans; however, EPA's industrial general permits also include State-specific conditions that may include additional numeric effluent limits.

67. **What is a storm water "best management practice" (BMP)?**

A. A BMP (defined at 9/9/92 Federal Register page 41319) is a technique, process, activity or structure used to reduce the pollutant content of a storm water discharge. BMPs include simple, nonstructural methods such as good housekeeping and preventive maintenance. Additionally, BMPs may include sophisticated, structural modifications such as the installation of sediment basins. The focus of EPA's general permits is on preventative BMPs which limit the release of pollutants into storm water discharges. EPA has published guidance materials to assist in the selection of appropriate BMPs in the preparation of storm water pollution prevention plans, including: *Storm Water Management for Industrial Activities: Developing Pollution Prevention Plans and Best Management Practices (PB-92-235969)* and *Storm Water Management for Construction Activities: Developing Pollution Prevention Plans and Best Management Practices (PB-*

92-235951). These Manuals are available from NTIS at (703) 487-1650 and the Office of Water Resource Center at (202)260-7786.

68. **What should a facility do when the nature of its activities changes?**

A. When the nature of a facility's activities changes, the facility must modify the pollution prevention plan accordingly. If the facility is subject to new monitoring requirements as a result of the changes, sampling must begin at the start of the next monitoring period.

69. **Is there a procedure for notifying EPA when a storm water discharge associated with industrial activity covered by EPA's general permit has been eliminated?**

A. Yes. EPA's general permits include procedures for filing a Notice of Termination (NOT) form when there is no longer a potential for storm water discharges associated with industrial activity to occur. Operators of construction activities can submit an NOT once they have finally stabilized all areas that were disturbed. For construction activity, final stabilization means that all soil disturbing activities at the site have been completed, and that a uniform perennial vegetative cover has been established or equivalent permanent stabilization measures (such as the use of riprap, gabions, or geotextiles) have been employed with a density of 70% of the previously existing/background cover for unpaved areas and areas not covered by permanent structures. A copy of the NOT can be found in Federal Register notices dated September 9, 1992 (57 FR 41232 and 41341), and September 25, 1992 (57 FR 44434 and 44469).

70. **If a NPDES authorized State has general permitting authority but has not yet finalized an applicable general permit, can a facility still submit an NOI and assume general permit coverage?**

A. No, a facility cannot submit an NOI to obtain coverage under a general permit until that permit has been finalized. Furthermore, a facility located in an NPDES State cannot seek coverage under one of EPA's general permits.

71. **Will State general permit requirements vary and to what extent?**

A. General permit requirements for authorized NPDES States may vary considerably because these States develop and issue permits independently from EPA. However, all NPDES permits must meet minimum technical and water quality-based requirements of the Clean Water Act. Permittees in NPDES authorized States should consult with their permitting authorities regarding particular State conditions. Under EPA's storm water general permits, State-specific requirements vary

because of different water quality concerns in different States. Each of the 12 non-authorized States and Territories provided certification that EPA's general permits comply with State water quality standards, and added permit requirements where necessary to achieve compliance with those standards in the final general permits.

72. Can discharges from industrial areas at a construction site such as portable asphalt plants and/or concrete batch plants be covered under EPA's construction general permits?

A. No. EPA's construction general permits only authorize discharges from the construction area; these permits do not authorize storm water discharges from industrial activities other than construction that are located on the construction site. Portable asphalt plants and/or concrete batch plants are considered to be "industrial activity," as defined 40 CFR 122.26(b)(14)(ii). Therefore, storm water discharges from such industrial activities must be in compliance with a general or individual storm water permit for industrial storm water discharges other than construction. At a construction site which disturbs less than 5 acres of land (and which is, therefore, not subject to storm water permit application requirements for the construction activity), the operator of the mobile asphalt or concrete plant still would be required to obtain storm water permit coverage for discharges from the plant. Please note that States with approved NPDES permit programs may allow portable asphalt plants and/or cement batch plants to be covered under the State's construction general permit.

V. Group Applications

73. How will group applicants be permitted?

A. EPA is currently developing a model permit using information from Part I and Part II group applications, and other sources. This model permit will have sections which address a particular type of industrial activity. When the model permit is completed, the permitting authority (EPA or NPDES States) then has the option to propose and issue final permits to cover group members within their state based upon the model permit.

VI. Sampling

74. For what parameters does a facility have to sample under the individual or group application?

A. Applicants are required to obtain quantitative data from samples collected during storm events from all outfalls that discharge storm water associated with industrial activity for the following parameters: (1) any pollutant limited in an effluent guideline to which the facility is subject; (2) Any pollutant listed in the facility's permit for its process wastewater [if the facility is operating under an existing NPDES permit]; (3) Oil and grease, pH, BOD5, COD, TSS, total phosphorous, total Kjeldahl nitrogen, and nitrate plus nitrite nitrogen; (4) certain toxic pollutants listed in Tables II and III of the Appendix D to 40 CFR Part 122 (also listed as Tables 2F-2 and 2F-3 in the instructions for Form 2F) that are expected to be present in the storm water.

75. For an individual or group application, how many aliquots (portions) of storm water are needed to obtain a flow-weighted composite?

A. A flow-weighted composite may be taken as a combination of a minimum of 3 sample aliquots taken in each hour of discharge for the entire event or for the first three hours of the event, with each aliquot collection being separated by a minimum of 15 minutes. If the storm event lasts less than three hours, aliquots should be collected for as long as there is sufficient flow. Large and medium municipalities may use a different protocol with respect to time duration between collection of aliquots with approval of the permitting authority. EPA's *NPDES Storm Water Sampling Guidance Document* discusses several ways to estimate flows. [This manual is available from the Storm Water Hotline (703) 821-4823) and the Office of Water Resource Center (202)260-7786].

76. How does a facility measure flow if there are numerous small outfalls?

A. Applicants may provide either measurements or estimates of storm water flows. One possible method for estimating flow is to create a conveyance that would combine flows from many of the outfalls. Alternatively, where flows are similar, the flow at one outfall may be measured to calculate flows at the other outfalls, provided that the method of measurement is indicated to the permitting authority. EPA's *NPDES Storm Water Sampling Guidance Document* discusses several ways to estimate flows. [This manual is available from the Storm Water Hotline (703) 821-4823) and the Office of Water Resource Center (202)260-7786.]

77. For what parameters is only a grab sample appropriate?

A. When collecting storm water samples, grab samples are required for the following parameters: pH, temperature, cyanide, total phenols, residual

chlorine, oil and grease, fecal coliform and fecal streptococcus. Both grab and composite samples are required for all other pollutants.

78. **Do both a grab and a composite sample have to be taken from a 24-hour holding pond?**

A. No. Only a minimum of one grab sample is required to be taken for effluent from holding ponds or other impoundments with a retention period of greater than 24 hours for the representative event.

79. **Can composite and grab samples be taken from separate events?**

A. Grab and composite samples for a given outfall should be taken from the same storm event to provide a basis for comparing the data. If this is impossible, information describing each storm event used for sample collection should be recorded and submitted with sampling results. However, applicants are advised that the permitting authority may request data to be collected from only one storm event.

80. **Is a facility required to sample all of its outfalls during a single storm event?**

A. No. Unless otherwise specified by the permitting authority, a facility may sample outfalls during different events provided that the storms meet the criteria established in the application regulations or in the applicable permit language. Information describing each storm event used for sample collection should be recorded and submitted with sampling results.

81. **If a facility has two conveyances that join and leave the site as one combined discharge, where should a sample be collected?**

A. If the discharge is composed entirely of storm water, the sampling point should be at the outfall as it leaves the property. If the discharge is a combination of process wastewater and storm water, the storm water component of the discharge should be sampled before it commingles with the process waste water discharges. If sampling at an outfall at the property boundaries is impossible because of safety reasons, inaccessibility, or a poor conveyance, sampling may be done closer to the discharge source.

82. **How long of a 'dry' period does a facility need before sampling?**

A. A 'dry' period needs to be at least 72 hours. More specifically, all samples must be collected from the discharge resulting from a storm event that

occurs at least 72 hours from the previously measurable (greater than 0.1 inches) storm event.

83. **If two or more outfalls at a facility have identical discharges, does each outfall have to be sampled?**

A. Where a facility has outfalls that discharge "substantially identical effluent," the permitting authority may allow the applicant to test only one outfall and report that the quantitative data are representative of the substantially identical outfalls. EPA's *NPDES Storm Water Sampling Guidance Document* (available from the Storm Water Hotline (703-821-4823)) provides information on how to prepare this petition, or the applicant should contact their permitting authority to determine what information is required.

84. **Do analyses for storm water need to be done by a certified lab?**

A. There is no Federal requirement to use a certified lab. However, certain States may require that a certified lab be used. Please note, analyses must comply with the analytical procedures set out in 40 CFR Part 136, as discussed below.

85. **What analytical methods must be used for the pollutants for which sampling is required?**

A. EPA-approved methods must be used where a method for a pollutant has been promulgated. 40 CFR Part 136 discusses required methods. If there is no approved method, the applicant may use any suitable method, but must provide a description of the method in its application. Additional information on general sampling issues can be obtained through the EPA's *NPDES Storm Water Sampling Guidance Document*. The manual is available from the Storm Water Hotline (703-821-4823).

VII. Municipal Permit Applications

86. **Once a municipal separate storm sewer system (MS4) has submitted Part 2 of its storm water permit application, when does the term of the permit actually begin?**

A. The term of the permit begins when a permit is issued by the permitting authority. Pursuant to 40 CFR 122.26(e)(7), storm water permits for discharges from MS4s are to be issued with in one year after submission of a complete application. Since applications for medium and large

municipal separate storm sewer systems were due on May 17, 1993 and November 16, 1992, respectively, this results in permit issuance by November 16, 1993 for large municipalities and by May 17, 1994 for medium municipalities.

87. **How is EPA incorporating 1990 census data into the storm water program?**

A. Most of the municipalities that meet the definition of either a large or medium MS4 based on the results of the 1990 Census have already begun to seek an NPDES permit. Headquarters is working with the Regions and States to determine the best way to incorporate the remaining municipal entities into the program.

88. **How does EPA envision the relationship between large and medium MS4 operators and NPDES permitting authorities in terms of addressing industrial storm water discharges to MS4s?**

A. EPA envisions a partnership between NPDES permitting authorities and operators of large and medium municipal separate storm sewer systems in controlling pollutants in storm water discharges associated with industrial activity through MS4s. In addition, NPDES storm water permits provide a basis for enforcement actions directly against the owner or operator of the storm water discharge associated with industrial activity.

A second NPDES permit will be issued to the operator of the large and medium MS4. This permit will establish the responsibilities of the municipal operators in controlling pollutants from storm water associated with industrial activity which discharges through their municipal system. Under this approach, municipal operators will be able to:

- Assist EPA in identifying priority storm water discharges associated with industrial activity through their system;
- Assist EPA in reviewing and evaluating storm water pollution prevention plans that industrial facilities are required to develop; and
- Assist EPA in compliance efforts regarding storm water discharges associated with industrial activity to their municipal system.

A more complete description of this policy is provided in the August 16, 1991 Federal Register (56 FR 40973).

VIII. The Intermodal Surface Transportation Efficiency Act of 1991 (Transportation Act)

89. How did the Transportation Act affect permitting requirements for municipalities under 100,000?

A. Storm water discharges from certain industrial activities owned or operated by municipalities with a population of less than 100,000 people were granted a moratorium from the October 1, 1992 deadline for storm water permit applications. Exceptions to this moratorium include discharges from powerplants, airports and uncontrolled sanitary landfills.

90. How does the Transportation Act impact privately owned or operated industrial activities located in municipalities under 100,000?

A. The provisions of the Transportation Act specifically address publicly owned or operated industrial activities. Privately owned facilities that have storm water discharges associated with industrial activity, as defined at 40 CFR 122.26(b)(14), must submit a permit application regardless of the size of the population of the municipality in which they are located.

91. What is an "uncontrolled sanitary landfill?"

A. An uncontrolled sanitary landfill (discussed in the 4/2/92 Federal Register, page 11410) is a landfill or open dump, whether in operation or closed, that does not satisfy the runon/runoff requirements established pursuant to subtitle D of the Solid Waste Disposal Act. However, landfills closed prior to October 9, 1991 are not subject to RCRA runon/runoff requirements, and therefore need not submit storm water permit applications if they are located in municipalities of less than 100,000 population. Landfills closed after October 9, 1991 and others that meet the above definition would be subject to the storm water permit application requirements.

92. If a municipally-owned sewage treatment plant is located in a municipality with a population of less than 100,000 people, but the service population is greater than 100,000 people, is the facility subject to the permitting requirements?

A. Yes, because service populations are used in determining population for publicly-owned treatment works [POTWs] (April 2, 1992 Federal Register page 11394). Additionally, where one sewer district operates a number of POTWs, the entire service population of the district will be used to determine the applicable population classification of all the POTWs operated by the district. For example, if a district with a cumulative

service population of 160,000 operates two sewage treatment plants, one of which serves 120,000 and the other which serves 40,000, both plants will be considered to be owned or operated by a municipality with a population of 100,000 or more.

93. **If a construction operation disturbing five or more acres is owned by a small municipality (a population of <u>less</u> than 100,000 people)but operated by a private contractor, is the activity regulated?**

A. No. If the construction activity is either owned or operated by a municipality with a population of less than 100,000 it would not be required to obtain a storm water permit during Phase I of the storm water program. Some States, however, may require that an application be submitted.

IX. 9th Circuit U.S. Court of Appeals Decision

94. **What is the current status of light manufacturing facilities without exposure and construction activities under five acres, pursuant to the 9th Circuit Court decision?**

A. The 9th Circuit Court decision remanded two "exemptions" provided in the NPDES storm water permit application regulations for light manufacturing facilities without exposure and construction activities under five acres (11/16/90 <u>Federal Register</u> page 48066). Both exemptions were remanded for further proceedings. In response to these two remands, the Agency intends to conduct further rulemakings on both the light manufacturing and construction activities under five acres. In the December 18, 1992, <u>Federal Register</u>, the Agency stated that it is <u>not requiring</u> permit applications from construction activity under five acres or light industry without exposure until this further rulemaking is completed.

X. Phase II of the Storm Water Program

95. **What is the difference between Phase I and Phase II of the NPDES storm water program?**

A. In the Water Quality Act of 1987, Congress mandated that EPA establish storm water control programs in two phases. While the first Phase I was defined on November 16, 1990, Phase II regulations were to be promulgated by October 1, 1992. However, the Water Resources Development Act (WRDA) of 1992 extended deadlines for Phase II of the

storm water program as follows: 1) EPA must issue Phase II regulations by October 1, 1993; and 2) permits for Phase II sources may not be required by EPA or the State prior to October 1, 1994. EPA is currently developing regulations that will implement Phase II of the storm water program. (See Question #1 for more information on Phase I).

96. **Will all storm water discharges that are not regulated under Phase I be regulated under Phase II of the storm water program (e.g., service stations, retail and wholesale businesses, parking lots, municipalities with populations of less than 100,000)?**

A. Not necessarily. Statutory provisions require that EPA, in consultation with State and local officials, issue regulations that designate additional Phase II sources for regulation to protect water quality. EPA is currently developing approaches to identify and control high risk Phase II sources. EPA requested initial public comments on a variety of Phase II issues on September 9, 1992 (57 FR 41344). As part of this process, EPA is considering all sources of storm water not regulated under Phase I for potential coverage under Phase II.

APPENDIX E

GROUP APPLICATION PART 2 SAMPLING DATA AND INDUSTRY DESCRIPTIONS ORGANIZED BY INDUSTRY SECTOR

APPENDIX E

GROUP APPLICATION PART 2 SAMPLING DATA AND INDUSTRY DESCRIPTIONS ORGANIZED BY INDUSTRY SECTOR

This appendix contains summary descriptions for the 31 industrial sectors that were identified in the group application portion of the Phase I permitting process (four of the sectors were consolidated into two sectors for permit development purposes). The summaries describe the industrial activities, significant materials, and pollutants of concern that were listed in the applications submitted by the industry groups. The descriptions also contain tables which summarize the sampling data submitted by the groups. The tables list the mean values, median values, 95th percentile values, for the grab and composite samples and the mean, median and 90th percentile values for NURP data for a portion of the pollutants sampled within each sector.

INDUSTRIAL SECTORS/GROUP APPLICATIONS	
SECTOR	ACTIVITIES REPRESENTED
1	Lumber and Wood Products
2	Paper and Allied Products
3	Chemicals and Allied Products
4	Asphalt and Lubricant Manufacturers
5	Stone, Clay, Glass and Concrete Products
6	Primary Metal Industries
7	Metal Mining
8	Coal and Lignite Mining
9	Oil and Gas Extraction
10	Mining and Quarrying of Nonmetallic Minerals
11	Hazardous Waste Treatment Storage or Disposal Facilities
12	Industrial Landfills, Land Application Sites and Open Dumps
13	Used Motor Vehicle Parts
14	Scrap and Waste Materials
15	Steam Electric Power Generating Facilities
16	Railroad Transportation
17	Local and Suburban Transit and Interurban Highway Passenger Transportation Motor Freight Transportation United States Postal Service Petroleum Bulk Stations
18	Water Transportation
19	Ship Building and Repairing Boat Building and Repairing
20	Transportation By Air
22	Domestic Wastewater Treatment Plants
23	Food and Kindred Products Tobacco Products
24	Textile Mill Products Apparel and Other Finished Products Made From Fabrics and Similar Materials
25	Furniture and Fixtures Manufacturing
26	Printing Publishing and Allied Industries
27	Rubber and Misc. Plastic Products
28	Leather and Leather Products
29	Fabricated Metal Products, Except Machinery and Transportation Equipment Jewelry, Silverware, and Plated Ware
30	Industrial and Commercial Machinery (Except Computer and Office Equipment) Transportation Equipment
31	Electronic and other Electrical Equipment and Components Measuring, Analyzing, and Controlling Instruments; Photographic and Optical Goods; Watches and Clocks

Sector 1: Timber Products Facilities

The definition of storm water discharges associated with industrial activity includes point source discharges of storm water from eleven major categories of facilities, including: "... category (ii) facilities classified as Standard Industrial Classification (SIC) code 24 (except 2434)." Storm water discharges covered include those from establishments that cut timber and pulpwood, merchant sawmills, lath mills, shingle mills, cooperage stock mills, planing mills, and plywood and veneer mills that produce lumber and wood basic materials; and establishments that manufacture finished articles made entirely of wood or related materials. These facilities use wood as their primary raw material. Industrial activities include the following:

Log Storage and Handling activities include loading and unloading of logs onto trucks or railroad cars for transport to other facilities, log sorting, and storage of logs. In addition, some cutting may be performed, such as chopping off tree branches and sectioning of tree trunks for easier handling during transport. Chipping may be performed at facilities serving pulp industries. Residues generated at these sites may include bark, coarse sawdust, and wood chunks.

Untreated Wood Lumber and Residue Generation Activities occur at the following: saw and planing mills (SIC group 242); millwork, veneer, plywood and structural wood member manufacturing facilities (SIC group 243); wood container manufacturing facilities (SIC group 244); wood building and mobile home manufacturing facilities (SIC group 245); and miscellaneous wood product manufacturers (SIC group 249). These facilities may engage in one or more activities such as log washing, bark removal, milling, sawing, resawing edging, trimming, planing, machining, air drying, and kiln drying. Some facilities generate residue as a product, while other facilities may generate residues as a waste product. A summary of the residues generated include: bark, wood chips, planer shavings, and sawdust.

Wood Surface Protection Activities are accomplished by one of the following three methods: spraying, dipping, and green chain operations. Industrial activities at saw mills with the potential to contaminate storm water include spills from surface protection areas, storage and mixing tank areas, treated wood drippage, transport or storage areas, maintenance and shop areas, and areas used for treatment/disposal of wastes. Fugitive emissions from negative pressure spraying activities and hand spraying surface protection formulations may also result in the contamination of storm water.

Wood Preservation Activities are accomplished by two steps. First, the moisture content of wood is reduced to increase its permeability (this is referred to as conditioning). After conditioning, wood is impregnated with a preservative for fire retardency, insecticidal resistance, and/or fungicidal resistance. Then, the wood stock is often subject to cleaning in order to remove excess preservative prior to stacking treated lumber products outside.

Wood Assembly/Fabrication Activities such as the fabrication of fiberboard, insulation board, and hardboard may involve the use of wax emulsions, paraffin, aluminum sulfate,

melamine formaldehyde, and miscellaneous thermosetting resins. These chemicals may be introduced as part of the board formation process or as a coating to maintain the board's integrity. In the formation of fiberboard/insulation board/hardboards, the digestion of pulp and fiber by mechanical, thermal, and sometimes chemical means takes place. Another operation which involves resinous agents is the formation of veneer. In this process, veneer is placed in hot ponds or vats to soften the wood. Veneer strips are removed and often bound by glue or a resinous agent. Glues are also used in the assembly of wood components. Other types of activities include the finishing of wood products. Stains, paints, lacquers, varnish, water repellents and sealants, etc. may be applied to some of the wood products.

Significant materials at timber products facilities which can contribute pollutants to storm water include: uncut logs, wood bark, wood chips wood shavings, sawdust, green lumber, rough and finished lumber, other waste wood material, non-hazardous wood ash, above and below ground fuel storage tanks, finishing chemicals, solvents and cleaners, petroleum, herbicides, pesticides, fertilizers, sawmill equipment, material handling equipment, boiler water treatment chemicals, scrap metals, scrap equipment and plastics, boiler blowdown water, and leachate from decaying organic matter.

Pollutants from timber products facilities generally include biological oxygen demand (BOD^5), total suspended solids (TSS), chemical oxygen demand (COD), leachate, wood wastes, chemicals, heavy metals, and pH.

Table E-1
Summary Statistics From (Part 2) Sampling Results by Industrial Sector
Industrial Sector 1

	Grab Samples (mg/l)				Composite Samples (mg/l)				NURP Results (mg/l)		
Pollutant	No.	Mean	Median	95%	No.	Mean	Median	95%	Mean	Median	90%
BOD5	198	39.63	13.00	193.00	200	45.37	17.00	135.50	12.00	9.00	15.00
COD	19	297.64	131.00	1500.00	198	242.50	122.50	1080.00	82.00	65.00	140.00
Copper	32	0.05	0.03	0.16	29	0.04	0.03	0.12	0.04	0.04	0.09
Lead									0.18	0.14	0.35
NO_2+NO_3-N	189	0.95	0.32	2.20	188	0.75	0.34	1.79	0.86	0.68	1.75
Oil & Grease	107	15.21	2.20	55.00					NR	NR	NR
P, Total	198	23.91	0.29	2.66	199	6.29	0.30	1.72	0.42	0.33	0.70
pH	211	7.17	7.30	8.56					NR	NR	NR
TKN	188	2.57	1.62	9.26	188	2.32	1.50	7.50	1.90	1.50	3.30
TSS	198	1108.42	242.00	4800.00	198	575.27	230.00	2288.00	180.00	100.00	300.00
Zinc	16	0.47	0.37	1.70	15	0.36	0.30	1.20	0.20	0.16	0.50

Sector 2: Paper And Allied Products Manufacturing Facilities

The definition of storm water discharges associated with industrial activity includes point source discharges of storm water from eleven major categories of facilities, including: "...category (ii) facilities classified as Standard Industrial Classification (SIC) code 26 (except 265 and 267)." Storm water discharges covered include those from establishments primarily engaged in the manufacture of pulps from wood and other cellulose fibers, and from rags; manufacture paper and paperboard; and the manufacture of paper and paperboard into converted products, such as paper coated off the paper machine, paper bags, paper boxes, and envelopes. This major group also includes facilities which manufacture bags of plastics film and sheet.

Significant materials include fuels (diesel and gasoline), lumber, paper, and paperboard.

Pollutants of concern include total suspended solids (TSS), biochemical oxygen demand (BOD), and chemical oxygen demand (COD).

Table E-2
Summary Statistics From (Part 2) Sampling Results by Industrial Sector
Industrial Sector 2

Pollutant	Grab Samples (mg/l)				Composite Samples (mg/l)				NURP Results (mg/l)		
	No.	Mean	Median	95%	No.	Mean	Median	95%	Mean	Median	90%
BOD5	121	34.72	8.00	115.00	111	24.25	8.00	93.00	12.00	9.00	15.00
COD	121	191.69	61.00	740.00	113	133.90	51.00	530.00	82.00	65.00	140.00
Copper	2	0.03	0.03	0.05	2	0.03	0.03	0.07	0.04	0.04	0.09
Lead	2	0.05	0.05	0.09	2	0.03	0.03	0.05	0.18	0.14	0.35
NO_2+NO_3-N	121	.095	0.50	3.93	111	0.76	0.47	2.44	0.86	0.68	1.75
Oil & Grease	122	3.69	1.00	15.00					NR	NR	NR
P, Total	120	0.39	0.18	1.06	111	0.36	0.16	0.91	0.42	0.33	0.70
pH	121		6.97	8.22					NR	NR	NR
TKN	121	3.83	1.76	10.20	112	3.17	1.77	10.10	1.90	1.50	3.30
TSS	121	152.98	41.00	520.00	111	44.04	13.00	198.00	180.00	100.00	300.00
Zinc	1	0.62	0.62	0.62	1	0.78	0.78	0.78	0.20	0.16	0.50

Sector 3: Chemical and Allied Products Manufacturing Facilities

The definition of storm water discharges associated with industrial activity includes point source discharges of storm water from eleven major categories of facilities, including: "... category (ii) facilities classified as Standard Industrial Classification (SIC) 28 (except 283 and 285)." Storm water discharges covered include those from establishments primarily engaged in manufacturing: industrial inorganic chemicals; plastic and synthetic materials; cleaning agents; paint products and varnishes; industrial organic chemicals; fertilizers; adhesives; explosives; and printing ink. Also covered are storm water discharges from facilities which manufacture inks and paints under SIC 3952. Storm water discharges from drug manufacturing facilities (SIC 283) are not covered.

Pollutants at chemical and allied product facilities include Biochemical Oxygen Demand (BOD), Chemical Oxygen Demand (COD), Copper, Manganese, and Zinc.

Table E-3
Summary Statistics From (Part 2) Sampling Results by Industrial Sector
Industrial Sector 3

Pollutant	Grab Samples (mg/l)				Composite Samples (mg/l)				NURP Results (mg/l)		
	No.	Mean	Median	95%	No.	Mean	Median	95%	Mean	Median	90%
BOD5	165	36.42	7.00	67.00	156	11.74	6.00	45.00	12.00	9.00	15.00
COD	168	96.14	57.50	290.00	159	77.24	41.00	320.00	82.00	65.00	140.00
Copper	51	0.19	0.01	0.21	46	0.12	0.00	0.19	0.04	0.04	0.09
Lead	47	0.07	0.01	0.17	42	0.02	0.01	0.07	0.18	0.14	0.35
NO_2+NO_3-N	164	5.83	0.80	16.00	154	4.29	0.82	17.00	0.86	0.68	1.75
Oil & Grease	169	3.75	0.50	16.30					NR	NR	NR
P, Total	170	2.82	0.24	12.10	158	9.51	0.23	16.40	0.42	0.33	0.70
pH	166	6.94	7.10	8.50					NR	NR	NR
TKN	171	15.50	1.90	27.00	159	18.30	1.70	23.70	1.90	1.50	3.30
TSS	169	200.33	40.00	793.00	159	93.67	25.00	453.00	180.00	100.00	300.00
Zinc	75	2.11	0.24	7.70	70	1.74	0.24	4.20	0.20	0.16	0.50

Sector 4: Asphalt Paving and Roofing Materials Manufacturers and Lubricant Manufacturers

The definition of storm water discharges associated with an industrial activity includes point source discharges of storm water from eleven major categories of facilities, including: "... category (ii) which identifies facilities classified as Standard Industrial Classification (SIC) code 29." This covers storm water discharges associated with industrial activities at facilities with a primary SIC code of 2951 (Asphalt Paving Mixtures and Blocks), 2952 (Asphalt Felts and Coatings), and 2992 (Lubricating Oils and Greases) including portable plants. Hereinafter, facilities with primary SIC codes 2951 or 2952 will be referred to as 'Asphalt Facilities,' and facilities with primary SIC code 2992 as 'Lubricant Manufacturers.'

Facilities manufacturing asphalt concrete, paving materials, or block, are classified as SIC code 2951. Facilities primarily engaged in manufacturing asphalt roofing products, such as asphalt felts, shingles, and other products including tars, pitch, and roofing cements, are identified as SIC 2952. Facilities primarily engaged in manufacturing oils and lubricants are identified as SIC 2992.

Manufacturers of Asphalt Paving Mixtures and Blocks: These facilities stockpile a variety of raw materials such as sand, gravel, crushed limestone, and recycled asphalt products (RAP). These facilities produce asphalt concrete, and may also mold and cure asphalt concrete products such as asphalt blocks. There are two types of facilities associated with these activities, batch plants and drum plants.

Manufacturers of Roofing Materials: Manufacturers classified in standard industrial code 2952 typically produce roofing felts, and impregnated roofing felts (shingles) and other products, such as tar papers, impregnated asphalt siding, expansion joints, roofing cements, tars and pitches. Many of the roofing products consist of materials coated with asphalt purchased from a vendor and then cured and stored out of doors until shipped.

Manufacturers of Lubricating Oils and Greases: Facilities primarily engaged in blending, compounding, and re-refining lubricating oils and greases from purchased mineral, animal, and vegetable materials are identified as SIC code 2992. SIC code 2992 includes manufacturers of metalworking fluids, cutting oils, gear oils, hydraulic brake fluid, transmission fluid, and other automotive and industrial oil and greases.

Significant materials at these facilities include additives, asphalt, asphalt cement, asphalt concrete, asphalt felt, asphalt release agents, asphalt shingles, crushed stone, fuel, granite, gravel, limestone, lubricants, mineral spirits, oil, quartzite rock, reclaimed asphalt pavement, sand, sandstone, and slag. The pollutants of concern at facilities which manufacture asphalt and lubricant include total, suspended solids (TSS), oil and grease, chemical oxygen demand (COD), and fuel wastes.

Table E-4
Summary Statistics From (Part 2) Sampling Results by Industrial Sector
Industrial Sector 4

Pollutant	Grab Samples (mg/l)				Composite Samples (mg/l)				NURP Results (mg/l)		
	No.	Mean	Median	95%	No.	Mean	Median	95%	Mean	Median	90%
BOD5	61	39.99	7.00	47.00	51	10.87	4.00	22.00	12.00	9.00	15.00
COD	64	151.55	48.00	485.00	53	86.93	50.00	375.00	82.00	65.00	140.00
Copper									0.04	0.04	0.09
Lead									0.18	0.14	0.35
NO_2+NO_3-N	62	0.97	0.31	2.63	52	0.82	0.03	2.43	0.86	0.68	1.75
Oil & Grease	64	5.89	1.25	28.00					NR	NR	NR
P, Total	63	0.37	0.13	1.65	54	0.28	0.15	1.28	0.42	0.33	0.70
pH	59	7.1	7.1	8.80					NR	NR	NR
TKN	63	2.13	1.13	7.16	51	1.63	0.99	6.28	1.90	1.50	3.30
TSS	63	286.67	93.00	1330.00	54	165.03	46.00	860.00	180.00	100.00	300.00
Zinc									0.20	0.16	0.50

Sector 5: Glass, Clay, Cement, Concrete, and Gypsum Product Manufacturing Facilities

The definition of storm water discharges associated with industrial activity includes point source discharges of storm water from eleven major categories of facilities, including: "...category (ii) which identifies facilities classified as Standard Industrial Classification (SIC) code 32."

Glass Product Manufacturing - Facilities primarily engaged in the manufacturing of glass and glassware, or manufacturing glass products from purchased glass are classified under standard industrial groups 321-323. Manufacturing processes include the storage of raw materials, weighing the materials, charging, melting and forming. Significant materials may include silica sand, limestones, feldspars, borates, soda ash, boric acid, potash and barium carbonate.

Cement Manufacturing - Facilities primarily engaged in manufacturing hydraulic cement (e.g., portland, natural, masonry, and pozzolana cements) are identified as SIC code 3241. The three basic steps in cement manufacturing are: 1) proportioning, grinding and blending raw materials; 2) heating raw materials to produce a hard, stony substance known as "clinker"; and 3) combining the clinker with other materials and grinding the mixture into a fine powdery form.

Clay Product Manufacturing - Facilities primarily engaged in manufacturing clay products, including brick, tile (clay or ceramic), or pottery products are classified as standard industrial groups 325 and 326. Although clay product manufacturing facilities produce a wide variety of final products, there are several similar processing steps shared by most facilities in this industry: 1) storage and preparation of raw materials; 2) forming; 3) drying; 4) firing; and 5) cooling. Manufacturers classified as standard industrial groups 325 and 326 typically use clay (common, silt, kaolin and/or phyllite) and shale (mud, red, blue and/or common) as their primary raw materials. Raw materials are generally stored outside.

Concrete Products - Facilities primarily engaged in manufacturing concrete products, including ready-mixed concrete, are identified as SIC group 327. Although concrete product facilities in SIC group 327 produce a variety of final products, they all have common raw materials and activities.

Concrete products manufacturers combine cement, aggregate, and water to form concrete. Aggregate generally consists of: sand, gravel, crushed stone, cinder, shale, slag, clay, slate, pumice, vermiculite, scoria, perlite, diatomite, barite, limonite, magnetite, or ilmenite. Admixtures including fly ash, calcium chloride, triethanolamine, calcium salt, lignosulfunic acid, vinosol, saponin, keratin, sulfonated hydrocarbon, fatty acid glyceride, vinyl acetate, and styrene copolymer of vinyl acetate may be added to obtain desired characteristics, such as slower or more rapid curing times.

Gypsum Products Manufacturing - Facilities primarily engaged in manufacturing plaster, wallboard, and other products composed wholly or partially of gypsum (except plaster of paris and papier-mâché) are classified as SIC code 3275. The gypsum product manufacturing process begins with calcining the gypsum: finely ground raw gypsum (referred to as "land plaster") is fed into imp mills or calcining kettles where extreme heat removes 75 percent of the gypsum's molecular moisture. The result is a dry powder called stucco, which is cooled and conveyed to storage bins. To produce wallboard, stucco is fed into pin mixers where it is blended with water and other additives to produce a slurry. The slurry is then applied to continuous sheets of paper to form wallboard. In addition to producing wallboard, some facilities may combine stucco with additives (excluding water) to produce plaster.

As a result of the industrial activities such as materials handling and storage and other industry specific activities, pollutants of concern include: total suspended solids (TSS), chemical oxygen demand (COD), oil and grease, lead, aluminum, zinc, potassium and sulfate.

Table E-5
Summary Statistics From (Part 2) Sampling Results by Industrial Sector
Industrial Sector 5

	Grab Samples (mg/l)				Composite Samples (mg/l)				NURP Results (mg/l)		
Pollutant	No.	Mean	Median	95%	No.	Mean	Median	95%	Mean	Median	90%
BOD5	310	14.30	5.00	32.00	300	7.32	4.20	26.00	12.00	9.00	15.00
COD	313	107.47	51.30	317.00	302	77.53	43.15	240.00	82.00	65.00	140.00
Copper	6	0.13	0.02	0.40	5	0.16	0.04	0.40	0.04	0.04	0.09
Lead	15	0.24	0.01	3.30	15	0.25	0.01	3.40	0.18	0.14	0.35
NO_2+NO_3-N	303	1.99	0.60	3.03	292	1.40	0.55	3.03	0.86	0.68	1.75
Oil & Grease	315	4.67	1.40	17.10					NR	NR	NR
P, Total	313	1.21	0.28	4.96	300	0.87	0.25	3.24	0.42	0.33	0.70
pH	297	8.59	8.50	11.30					NR	NR	NR
TKN	304	3.82	1.16	7.00	292	2.37	1.00	5.00	1.90	1.50	3.30
TSS	311	1066.79	200.00	2620.00	302	385.51	149.00	1440.00	180.00	100.00	300.00
Zinc	8	0.35	0.14	1.17	7	0.39	0.18	1.12	0.20	0.16	0.50

Sector 6: Primary Metals Facilities

The definition of storm water discharges associated with industrial activity includes point source discharges from eleven major categories of facilities, including: "(ii) facilities classified as Standard Industrial Classification (SIC) 33 [primary metals facilities]." Storm water discharges covered include those from the following types of activities: Steel works, blast furnaces, and rolling and finishing mills (SIC 331); Iron and steel foundries (SIC 332) Primary smelting and refining of nonferrous metals (SIC 333); Secondary smelting and refining of nonferrous metals (SIC 334); Rolling, drawing, and extruding of nonferrous metals (SIC 335); Nonferrous foundries (SIC 336); and Miscellaneous primary metal products, not elsewhere classified (SIC 339).

Facilities in the primary metals industry are typically involved in one or more of the following general operations: raw material storage and handling; furnace and oven related processes; preparation of molds, casts, or dies; metal cleaning, treating and finishing; and waste handling and disposal.

Pollutants at primary metals facilities include Aluminum, Copper, Iron, Manganese, Total Suspended Solids (TSS), and Zinc.

Table E-6
Summary Statistics From (Part 2) Sampling Results by Industrial Sector
Industrial Sector 6

	Grab Samples (mg/l)				Composite Samples (mg/l)				NURP Results (mg/l)		
Pollutant	No.	Mean	Median	95%	No.	Mean	Median	95%	Mean	Median	90%
BOD5	163	32.15	11.00	83.00	140	34.08	8.30	61.50	12.00	9.00	15.00
COD	162	221.34	70.50	870.00	151	109.84	60.00	420.00	82.00	65.00	140.00
Copper	143	3.46	0.10	3.40	131	2.25	0.07	3.10	0.04	0.04	0.09
Lead	136	0.78	0.02	1.41	123	0.19	0.02	1.00	0.18	0.14	0.35
NO_2+NO_3-N	148	1.17	0.68	3.60	135	1.38	0.77	4.30	0.86	0.68	1.75
Oil & Grease	163	8.88	1.00	47.00					NR	NR	NR
P, Total	163	1.25	0.17	1.80	149	0.52	0.14	0.96	0.42	0.33	0.70
pH	163	7.07	7.30	8.90					NR	NR	NR
TKN	160	3.56	1.98	13.00	149	3.05	1.60	9.70	1.90	1.50	3.30
TSS	162	368.45	71.75	1700.00	149	162.28	69.00	717.00	180.00	100.00	300.00
Zinc	144	8.85	0.46	11.80	132	6.55	0.43	9.67	0.20	0.16	0.50

Sector 7: Metal Mining (Ore Mining and Dressing)

The definition of storm water discharges associated with industrial activity includes point source discharges of storm water from eleven major categories of facilities, including: "...category (iii) facilities classified by Standard Industrial Classification (SIC) codes 10 through 14 including active or inactive mining operations (except for areas coal mining operations no longer meeting the definition of reclamation area under 40 CFR 434.11(l) because the performance bond issued to the facility by the appropriate SMCRA authority has been released, or except for areas of non-coal mining operations which have been released from applicable State or Federal reclamation requirements after December 17, 1990) and oil and gas exploration production, processing or treatment operations, or transmission facilities that discharge storm water contaminated by contact with or that has come into contact with any overburden, raw material, intermediate products, finished products, byproducts or waste products located on the site of such operations." The following is a listing of the types of mining/milling facilities that are covered under SIC code 10:

- Iron Ores (SIC 1011)
- Copper Ores (SIC 1021)
- Lead and Zinc Ores (SIC 1031)
- Gold Ores (SIC 1041)
- Silver Ores (SIC 1044)
- Ferroalloy Ores, Except Vanadium (SIC 1061)
- Metal Mining Services (SIC 1081)
- Uranium-Radium-Vanadium Ores (SIC 1094)
- Miscellaneous Metal Ores, Not Elsewhere Classified (SIC 1099)

The term "metal mining" includes all ore mining and/or dressing and beneficiating operations, whether performed at mills operated in conjunction with the mines served or at mills, such as custom mills, operated separately. The above establishments are primarily engaged in mining, developing mines, or exploring for metallic minerals (ores). This group also includes all ore dressing and beneficiating operations, whether performed at mills operated in conjunction with the mines served or at mills, such as custom mills, operated separately. These include mills which crush, grind, wash, dry, sinter, calcine, or leach ore, or perform gravity separation or flotation operations.

Pollutants of concern include total suspended solids (TSS), total dissolved solids (TDS), heavy metals, oil and grease, dust, and turbidity.

Table E-7
Summary Statistics From (Part 2) Sampling Results by Industrial Sector
Industrial Sector 7

Pollutant	Grab Samples (mg/l)				Composite Samples (mg/l)				NURP Results (mg/l)		
	No.	Mean	Median	95%	No.	Mean	Median	95%	Mean	Median	90%
BOD5	18	10.02	9.00	27.00	12	10.63	6.00	44.00	12.00	9.00	15.00
COD	18	144.54	71.10	630.00	15	195.07	160.00	740.00	82.00	65.00	140.00
Copper	19	3.88	0.14	46.80	13	0.59	0.09	3.40	0.04	0.04	0.09
Lead	23	0.89	0.00	1.20	13	6.07	0.05	65.00	0.18	0.14	0.35
NO_2+NO_3-N	16	1.10	0.75	5.30	13	0.90	0.86	2.10	0.86	0.68	1.75
Oil & Grease	16	2.36	0.00	22.00					NR	NR	NR
P, Total	21	1.83	0.30	11.00	16	1.06	0.38	7.00	0.42	0.33	0.70
pH	24	7.23	7.45	8.00					NR	NR	NR
TKN	15	3.27	2.60	9.40	13	3.39	3.20	11.80	1.90	1.50	3.30
TSS	17	6995.78	403.00	100000.00	15	623.09	330.00	3049.00	180.00	100.00	300.00
Zinc	14	3.04	0.59	16.30	8	3.87	0.66	20.90	0.20	0.16	0.50

Sector 8: Coal Mines and Coal Mining-Related Facilities

The definition of storm water discharges associated with industrial activity includes point source discharges of storm water from eleven major categories of facilities, including: "...category (iii) facilities classified by Standard Industrial Classification (SIC) codes 10 through 14 including active or inactive mining operations (except for areas coal mining operations no longer meeting the definition of reclamation area under 40 CFR 434.11(l) because the performance bond issued to the facility by the appropriate SMCRA authority has been released, or except for areas of non-coal mining operations which have been released from applicable State or Federal reclamation requirements after December 17, 1990) and oil and gas exploration production, processing or treatment operations, or transmission facilities that discharge storm water contaminated by contact with or that has come into contact with any overburden, raw material, intermediate products, finished products, byproducts or waste products located on the site of such operations." Coal mining activities are classified as Standard Industrial Classification (SIC) code 12, and includes the following operations:

- Bituminous Coal and Lignite Surface Mining (SIC 1221)
- Bituminous Coal Underground Mining (SIC 1222)
- Anthracite Mining (SIC 1231)
- Coal Mining Services (SIC 1241)

Storm water discharges are covered at all inactive facilities and only from haul roads and rail lines at active facilities. Haul roads are non-public roads on which coal or coal refuse is conveyed. Access roads are non-public roads providing light vehicular traffic within the facility property and to public roadways. Railroad spurs, sidings, and internal haulage lines are rail lines used for hauling coal within the facility property and to off-site commercial railroad lines or loading areas. Inactive coal mines and related areas are abandoned and other inactive mines, refuse disposal sites and other mining-related areas.

Significant materials include coal, refuse coal, used equipment, and other equipment used to haul coal.

Pollutants of concern include total suspended solids (TSS), total dissolved solids (TDS), turbidity, oil and grease, dust, heavy metals, and acid/alkaline wastes.

Table E-8
Summary Statistics From (Part 2) Sampling Results by Industrial Sector
Industrial Sector 8

Pollutant	Grab Samples (mg/l)				Composite Samples (mg/l)				NURP Results (mg/l)		
	No.	Mean	Median	95%	No.	Mean	Median	95%	Mean	Median	90%
BOD5	7	3.63	1.80	9.00	4	6.55	3.90	17.40	12.00	9.00	15.00
COD	13	16.45	6.00	83.90	8	26.86	13.50	115.00	82.00	65.00	140.00
Copper	1	0.00	0.00	0.00	2	0.00	0.00	0.00	0.04	0.04	0.09
Lead	2	0.02	0.02	0.04	2	0.00	0.00	0.00	0.18	0.14	0.35
NO_2+NO_3-N	8	0.77	0.40	3.12	6	1.00	0.61	3.12	0.86	0.68	1.75
Oil & Grease	19	2.17	1.20	13.90					NR	NR	NR
P, Total	8	0.12	0.04	0.66	5	0.12	0.00	0.58	0.42	0.33	0.70
pH	21	7.40	7.58	8.45					NR	NR	NR
TKN	9	2.56	2.60	5.20	8	2.65	1.46	7.40	1.90	1.50	3.30
TSS	10	5607.60	150.00	33240.00	8	689.75	251.00	3880.00	180.00	100.00	300.00
Zinc	2	0.17	0.17	0.30	2	0.06	0.06	0.09	0.20	0.16	0.50

Sector 9: Oil and Gas Extraction Facilities

The definition of storm water discharges associated with industrial activity includes point source discharges of storm water from eleven major categories of facilities, including: "...category (iii)...oil and gas exploration production, processing or treatment operations, or transmission facilities that discharge storm water contaminated by contact with or that has come into contact with any overburden, raw material, intermediate products, finished products, byproducts or waste products located on the site of such operations." Oil and gas extraction facilities are classified as Standard Industrial Classification (SIC) code 13. The activities subject to storm water regulations include the following types of operations:

- Crude Petroleum and Natural Gas (SIC 1311)
- Natural Gas Liquids (SIC 1321)
- Drilling Oil and Gas Wells (SIC 1321)
- Oil and Gas Field Exploration Services (SIC 1382)
- Oil and Gas Field Services, Not Elsewhere Classified (SIC 1389)

Table E-9
Summary Statistics From (Part 2) Sampling Results by Industrial Sector
Industrial Sector 9

Pollutant	Grab Samples (mg/l)				Composite Samples (mg/l)				NURP Results (mg/l)		
	No.	Mean	Median	95%	No.	Mean	Median	95%	Mean	Median	90%
BOD5	35	13.79	9.71	44.00	33	10.59	7.00	21.80	12.00	9.00	15.00
COD	36	140.12	82.00	352.00	31	115.94	92.00	445.00	82.00	65.00	140.00
Copper									0.04	0.04	0.09
Lead									0.18	0.14	0.35
NO_2+NO_3-N	35	0.52	0.15	4.10	31	0.60	0.12	3.30	0.86	0.68	1.75
Oil & Grease	36	10.18	3.00	49.00					NR	NR	NR
P, Total	36	15.82	0.18	144.90	33	3.41	0.07	19.46	0.42	0.33	0.70
pH	36	7.45	7.14	9.41					NR	NR	NR
TKN	36	1.39	0.76	5.20	30	1.69	0.93	5.67	1.90	1.50	3.30
TSS	37	353.00	75.00	1520.00	30	413.00	48.00	2056.00	180.00	100.00	300.00
Zinc									0.20	0.16	0.50

Sector 10: Mineral Mining and Processing Facilities

The definition of storm water discharges associated with industrial activity includes point source discharges of storm water from eleven major categories of facilities, including: "...(iii) facilities classified as Standard Industrial Classifications 10 through 14 (mineral industry) including active or inactive mining operations (except for areas of coal mining operations no longer meeting the definition of a reclamation area under 40 CFR 434.11(l) because the performance bond issued to the facility by the appropriate SMCRA authority has been released, or except for areas of non-coal mining operations which have been released from applicable State or Federal reclamation requirements after December 17, 1990) and oil and gas exploration, production, processing, or treatment operations, or storm water contaminated by contact with, any overburden, raw material, intermediate products, finished products, by-products or waste products located on the site of such operations."

Mineral mining and processing facilities subject to storm water regulations include the following types of operations:

- Dimension Stone, (SIC Code 1411);
- Crushed and Broken Limestone, (SIC Code 1422);
- Crushed and Broken Granite, (SIC Code 1423);
- Crushed and Broken Stone, (SIC Code 1429);
- Construction Sand and Gravel, (SIC Code 1442);
- Industrial Sand and Gravel, (SIC Code 1446);
- Kaolin and Ball Clay, (SIC Code 1455);
- Clay, Ceramic, and Refractory Minerals, (SIC Code 1459);
- Potash, Soda, and Borate Minerals, (SIC Code 1474);
- Phosphate Rock, (SIC Code 1475);
- Chemical and Fertilizer Mineral Mining, (SIC Code 1479); and
- Miscellaneous Nonmetallic Minerals, Except Fuels, (SIC Code 1499).

There are typically three phases to a mining operation: the exploration and construction phase; the active phase; and the reclamation phase. The exploration and construction phase entails exploration and a certain amount of land disturbance to determine the financial viability of a site. Construction includes building of site access roads, and removal of overburden and waste rock to expose minable ore. These land-disturbing activities are significant potential sources of storm water contaminants. The active phase includes each step from extraction through production of a saleable product. The active phase may include periods of inactivity due to the seasonal nature of these mineral mining activities. The final phase of reclamation is intended to return the land to its pre-mining state. Non-metallic minerals are recovered using four basic forms of extraction techniques: open pit, open face or quarry mining; dredging; solution mining; and underground mining. Each type of extraction method may be followed by varying methods of beneficiation and processing.

Storm water discharges covered include all discharges where precipitation and run-on come into contact with significant materials commonly found at mining facilities which include:

overburden; waste rock; sub-ore piles; tailings; petroleum-based products; solvents and detergents; manufactured products; and other waste materials. This includes storm water discharges from haul roads, access roads, and rail lines used or traveled by carriers of raw materials, manufactured products, waste materials, or by-products created by the facility. In addition, overflows from facilities governed by effluent limitation guidelines with impoundments such as settling or sedimentation ponds, tailings ponds or piles, or other impoundments designed to contain a 10-year, 24-hour storm event are also covered.

Because of the land-disturbing nature of the mineral mining and processing industry, contaminants of concern generated by industrial activities in this industry include total suspended solids (TSS), total dissolved solids (TDS), turbidity, pH, dust, heavy metals, solvents, and oils.

Table E-10
Summary Statistics From (Part 2) Sampling Results by Industrial Sector
Industrial Sector 10

	Grab Samples (mg/l)				Composite Samples (mg/l)				NURP Results (mg/l)		
Pollutant	No.	Mean	Median	95%	No.	Mean	Median	95%	Mean	Median	90%
BOD5	55	7.09	5.00	24.00	51	6.89	5.00	17.00	12.00	9.00	15.00
COD	56	58.79	33.00	247.00	51	66.20	37.00	185.00	82.00	65.00	140.00
Copper	6	0.05	0.01	0.15	4	0.01	0.01	0.01	0.04	0.04	0.09
Lead	6	0.00	0.00	0.00	4	0.00	0.00	0.00	0.18	0.14	0.35
NO_2+NO_3-N	50	0.98	0.65	3.00	45	1.27	0.76	4.17	0.86	0.68	1.75
Oil & Grease	60	1.08	0.00	5.45					NR	NR	NR
P, Total	55	0.84	0.20	4.69	51	1.13	0.24	2.61	0.42	0.33	0.70
pH	58	7.60	7.55	9.10					NR	NR	NR
TKN	55	1.81	1.05	8.00	50	2.41	0.84	6.89	1.90	1.50	3.30
TSS	55	1848.14	181.00	11120.00	51	1576.24	296.00	10080.00	180.00	100.00	300.00
Zinc	5	0.18	0.18	0.34	3	0.29	0.30	0.30	0.20	0.16	0.50

Sector 11: Hazardous Waste, Treatment, Storage, or Disposal Facilities

The definition of storm water discharges associated with industrial activity includes point source discharges of storm water from eleven major categories of facilities, including: "...(iv) hazardous waste treatment, storage, or disposal facilities, including those that are operating under Subtitle C of RCRA [Resource Conservation and Recovery Act] ...." Industrial activities at treatment, storage, or disposal facilities (TSDF) can be described as follows:

At TSDFs, some wastes are disposed without any intervening storage or treatment, while other wastes are held in storage prior to treatment or disposal. Hazardous wastes are generally stored in containers and tanks, which are enclosed by a bermed area to prevent any releases to the environment from the storage units.

The processes for treating hazardous wastes can be divided into two major categories based on whether the waste is organic or inorganic in nature. Organic wastes are treated by destructive technologies, such as incineration, whereas inorganic wastes are treated using fixation technologies, such as stabilization, in which the hazardous constituents are immobilized in the residual matrix. Residuals from fixation processes are usually land-disposed.

Hazardous waste disposal units include landfills, surface impoundments, waste piles, and land treatment units. Wastes are also disposed of in incinerators. Some liquid hazardous wastes are underground-injected into deep wells regulated under the Underground Injection Control (UIC) program.

Hazardous wastes are also recycled at TSDFs. Recycling is considered a form of treatment, however, the recycling process itself is not generally regulated under RCRA. Recycling activities include reclamation, regeneration, reuse, burning for energy or materials recovery, and use in a manner constituting disposal (i.e., land application of hazardous waste or products containing hazardous waste).

Table E-11
Summary Statistics From (Part 2) Sampling Results by Industrial Sector
Industrial Sector 11

Pollutant	Grab Samples (mg/l)				Composite Samples (mg/l)				NURP Results (mg/l)		
	No.	Mean	Median	95%	No.	Mean	Median	95%	Mean	Median	90%
BOD5	8	17.75	11.50	45.00	9	9.44	7.00	45.00	12.00	9.00	15.00
COD	8	177.40	41.00	500.00	9	48.90	34.00	131.00	82.00	65.00	140.00
Copper									0.04	0.04	0.09
Lead									0.18	0.14	0.35
NO_2+NO_3-N	9	0.46	0.47	0.79	9	0.39	0.34	0.67	0.86	0.68	1.75
Oil & Grease	9	9.33	0.00	74.00					NR	NR	NR
P, Total	9	0.24	0.07	1.60	9	0.11	0.09	0.32	0.42	0.33	0.70
pH	7	6.93	7.29	7.79					NR	NR	NR
TKN	9	1.43	1.30	3.00	9	1.07	0.92	3.92	1.90	1.50	3.30
TSS	8	337.63	127.50	1100.00	9	82.67	32.00	304.00	180.00	100.00	300.00
Zinc									0.20	0.16	0.50

Sector 12: Landfills/Land Application Sites

The definition of storm water discharge associated with industrial activity includes point source discharges of storm water from eleven major categories of facilities, including: "...category (v) landfills, land application sites and open dumps that receive industrial wastes." Special conditions apply to land disposal sites which meet the definition of a landfill under RCRA Subtitle D. Landfills are defined as areas of land or excavation in which wastes are placed for permanent disposal, and that are not land application units, surface impoundments, injection wells, or waste piles. Included in this definition are municipal solid waste landfills (MSWLFs) and industrial solid non-hazardous waste landfills. Land application sites are defined as facilities at which wastes are applied onto or incorporated into the soil surface for the purpose of beneficial use or waste treatment and disposal. Open dumps are defined as solid waste disposal units not in compliance with State/Federal criteria established under RCRA Subtitle D.

Municipal Solid Waste Landfills are constructed according to one of two generic designs, the trench method, area method, or a combination of both. The trench method requires the excavation of a trench into which wastes will be placed. In the area method, wastes are placed directly on the ground surface and disposal follows the natural contours of the land. Some landfills use combinations of the two methods at different times depending on the location of the active unit.

Most modern landfills contain one or more separate "units," which are final waste containment areas. Active units continue to receive wastes until they have reached disposal capacity. When capacity is reached, a unit is capped with a final cover, and additional wastes are placed in other active units. Within each unit, wastes are added in layers referred to as lifts. Received wastes are spread across the working face of the landfill to a depth of six to twenty feet and then compacted. At the end of each working day a thin layer of soil (daily cover) is spread on top of the added wastes and compacted. A large unit may consist of multiple lifts, depending on the planned final depth. When a landfill (or landfill unit) has reached disposal capacity, a final cover is applied. Final covers generally provide a relatively impermeable cap over which topsoil is placed and vegetation is established.

Industrial Landfills are similar to MSWLFs, but only receive wastes from industrial facilities such as factories, processing plants, and manufacturing sites. These facilities may also receive hazardous wastes from very small quantity hazardous waste generators (less than one hundred kilograms per month), as defined in RCRA Subtitle C.

Land Application Sites receive wastes (primarily wastewaters and sludges) from facilities in virtually every major industrial category. Typically, individual land application sites will only dispose of wastes with specific characteristics. However, the criteria for selection are site-specific, depending on type of process used and the soil characteristics.

The significant materials at land disposal sites consist of the wastes and the equipment used to handle the wastes. Examples of wastes disposed at these sites include household waste

(including household hazardous waste which is excluded from RCRA hazardous waste regulation), non-hazardous incinerator ashes, commercial wastes, yard wastes, tires, white goods, construction wastes, municipal and industrial sludges, asbestos, and other industrial wastes from various industrial facilities.

Pollutants of concern at land disposal sites include total suspended solids (TSS), oil and grease, heavy metals, leachate, organics, and chemical oxygen demand (COD) and other toxic pollutants.

Table E-12
Summary Statistics From (Part 2) Sampling Results by Industrial Sector
Industrial Sector 12

Pollutant	Grab Samples (mg/l)				Composite Samples (mg/l)				NURP Results (mg/l)		
	No.	Mean	Median	95%	No.	Mean	Median	95%	Mean	Median	90%
BOD5	51	13.66	7.00	59.00	48	9.04	4.40	34.00	12.00	9.00	15.00
COD	51	114.46	31.00	825.00	48	102.02	27.50	548.00	82.00	65.00	140.00
Copper									0.04	0.04	0.09
Lead	9	9.62	0.08	83.70	7	20.64	0.18	143.00	0.18	0.14	0.35
NO_2+NO_3-N	50	1.57	0.55	4.10	47	1.38	0.50	6.02	0.86	0.68	1.75
Oil & Grease	53	2.97	0.00	14.00					NR	NR	NR
P, Total	50	0.91	0.50	3.35	47	0.95	0.38	4.08	0.42	0.33	0.70
pH	54	7.41	7.32	8.40					NR	NR	NR
TKN	51	3.36	1.10	12.00	48	3.03	1.04	14.20	1.90	1.50	3.30
TSS	51	2978.97	633.00	19370.00	47	1850.17	370.00	9140.00	180.00	100.00	300.00
Zinc									0.20	0.16	0.50

Sector 13: Automobile Salvage Yards

The definition of storm water discharges associated with industrial activity includes point source discharges of storm water from eleven categories of facilities, including: "... category (vi) facilities classified as Standard Industrial Classification (SIC) code 5015." That SIC code includes battery reclaimers, salvage yards, and automobile junkyards.

Storm water discharges include discharges where precipitation and storm water runon come into contact with significant materials including, but are not limited to parts storage and cleaning, storage of junked vehicles, waste products, by-products, stored materials, fuels, and areas used for dismantling operations. Dismantlers are a major source for replacement parts for motor vehicles in service. The primary activity involves the dismantling or wrecking of used motor vehicles. Some facilities, however, perform vehicle maintenance and may rebuild vehicles for resale.

Typically, automobile dismantling facilities receive vehicles that are either uneconomical to run or wrecks that are uneconomical to repair. The nature of operations generally depends on the size and location of the facility. In urban areas where land is more valuable, vehicles are typically dismantled upon arrival, parts are segregated, cleaned, and stored. Remaining hulks are generally sold to scrap dealers rather than stored on site due to limited space. In more rural areas, discarded vehicles are typically stored on the lot and parts removed as necessary. Remaining hulks are sold to scrap dealers less frequently.

Once a used vehicle is brought to the site, fluids may be drained and the tires, gas tank, radiator, engine and seats may be removed. The dismantler may separate and clean parts. Such cleaning may include steam cleaning of the engine and transmission as well as the use of solvents to remove oil and grease and other residues. Usable parts are then inventoried and stored for resale. The remaining car and/or truck bodies are stored on site for future sale of the sheet metal and glass. Stripped vehicles and parts that have no resale value are typically crushed and sold to a steel scrapper. Some operations may, however, convert used vehicles and parts into steel scrap as a secondary operation. This is accomplished by incineration, shearing (bale shearer), shredding, or baling.

Significant materials include automobile parts (e.g., engine blocks, mufflers, batteries), solvents, oils, cleaning agents (e.g., detergents), used equipment, and junked automobiles. Due to the nature of the industrial activities at these facilities, pollutants of concern include: oil and grease, ethylene glycol, heavy metals, petroleum hydrocarbons, solvents, suspended solids, acid/alkaline wastes, detergents, phosphorus and salts.

Table E-13
Summary Statistics From (Part 2) Sampling Results by Industrial Sector
Industrial Sector 13

Pollutant	Grab Samples (mg/l)				Composite Samples (mg/l)				NURP Results (mg/l)		
	No.	Mean	Median	95%	No.	Mean	Median	95%	Mean	Median	90%
BOD5	13	7.15	6.00	16.00	30	12.61	6.50	48.00	12.00	9.00	15.00
COD	30	135.00	61.00	250.00	13	66.23	60.00	155.00	82.00	65.00	140.00
Copper									0.04	0.04	0.09
Lead									0.18	0.14	0.35
NO_2+NO_3-N	13	1.70	0.83	5.65	30	1.62	1.32	4.87	0.86	0.68	1.75
Oil & Grease	30	5.35	3.00	32.00					NR	NR	NR
P, Total	13	0.19	0.05	1.08	30	3.05	0.26	15.70	0.42	0.33	0.70
pH	29	7.38	7.41	8.20					NR	NR	NR
TKN	13	2.17	1.90	4.87	30	2.27	1.77	6.63	1.90	1.50	3.30
TSS	13	474.39	183.00	2300.00	30	839.07	226.00	5100.00	180.00	100.00	300.00
Zinc									0.20	0.16	0.50

Sector 14: Scrap and Waste Material Processing and Recycling Facilities

The definition of storm water discharge associated with industrial activity includes point source discharges from eleven major categories of facilities, including: ". . . category (vi) facilities involved in the recycling of materials, including metal scrapyards, battery reclaimers, salvage yards and automobile junk yards, including but limited to those classified as Standard Industrial Classification (SIC) 5093 and 5015." Automobile junk yards (SIC 5015) are addressed under Sector 13.

SIC 5093 includes establishments engaged in assembling, breaking up, sorting and the wholesale distribution of scrap and recyclable waste materials including bag, bottle and box wastes, fur cuttings, iron and steel scrap, metal and non-ferrous metal scrap, oil, plastics, rags, rubber, textiles, waste paper and rag wastes.

Table E-14.1
Materials and Sources of Pollutants of Concern

Significant Materials: White Goods (Appliances) Potential Sources: Leaking oil-filled capacitors, ballasts, leaking compressors, pumps, leaking pressure vessels, reservoirs, sealed electrical components and chipped or deteriorated painted surfaces Pollutants of Concern: PCBs, oil, lubricants, paint pigments or additives such as lead, and other heavy metals
Significant Materials: Ferrous and Non-ferrous turnings and cuttings Potential Sources: Cutting oil residue, metallic fines Pollutants of Concern: Oil, heavy metals
Significant Materials: Materials from Demolition projects Potential Source: Deteriorated/damaged insulation, chipped painted surfaces, lead, copper, and steel pipes Pollutants of Concern: asbestos fibers, lead, copper, zinc, cadmium, other metals

Table E-14.1
Materials and Sources of Pollutants of Concern (continued)

Significant Materials: Electrical Components, transformers, switch gear, mercury float switches, sensors Potential Sources: Leaking oil-filled transformer casings, oil-filled switch, float switches, radioactive materials in gauges, sensors Pollutants of Concern: PCBs, oils, mercury, ionizing radioactive isotopes
Significant Materials: Fluorescent lights, light fixtures Potential Sources: Leaking ballasts Pollutants of Concern: PCBs, oil
Significant Materials: Food/Beverage Dispensing Equipment Potential Sources: Leaking fluorescent light ballasts, chipped painted surfaces Pollutants of Concern: PCBs, oil, heavy metals from paint pigments and additives
Significant Materials: Hospital and Dental Waste & Equipment Potential Sources: Drums/containers of hospital waste, shielding from diagnostic and other medical equipment, radioactive materials from gauges, sensors and diagnostic equipment Pollutants of Concern: Infectious/bacterial contamination, lead, ionizing radioactive isotopes
Significant Materials: Instruments Potential Sources: Radioactive material from thickness gages Pollutants of Concern: Ionizing radioactive isotopes
Significant Materials: Insulated wire Potential Sources: Insulation and other coatings, wire Pollutants of Concern: Lead, zinc, copper

Table E-14.1
Materials and Sources of Pollutants of Concern (continued)

Significant Materials: Lawnmowers, snowmobiles, motorcycles Potential Sources: Leaking engines, transmissions, fuel, oil reservoirs,leaking batteries Pollutants of Concern: Oils, transmission and brake fluids, fuel, grease, battery acid, lead acid
Significant Materials: Light gage materials Potential Sources: Deteriorating insulation, painted surfaces and other coatings Pollutants of Concern: Asbestos, lead, chromium
Significant Materials: Locomotives, rail cars Potential Sources: Leaking fuel reservoirs, fittings, hydraulic components, engines, bearings, compressors, oil reservoirs, worn brake pads, damaged insulation Pollutants of Concern: PCBs, diesel fuel, hydraulic oil, oil, brake fluid, grease from fittings, asbestos,
Significant Materials: Motor Vehicle Bodies, Engines, Transmissions, Exhaust systems Potential Sources: Leaking fuel tanks, oil reservoirs, transmission housings, brake fluid reservoir and lines, brake cylinders, shock absorber casing, engine coolant, wheel weights, leaking battery casings/housings and corroded terminals, painted surfaces and corrosion inhibitors, exhaust system, catalytic converters Pollutants of Concern: Fuel, benzene, oil, hydraulic oil, transmission fluids, brake fluids, ethylene glycol (antifreeze), lead, lead acid, lead oxides, cadmium, zinc, other heavy metals
Significant Materials: Misc. Machinery and obsolete equipment Potential Sources: Leaking reservoirs, damaged or chipped painted surfaces/coatings Pollutants of Concern: Fuel, oil, lubricants, lead, cadmium, zinc

Table E-14.1
Materials and Sources of Pollutants of Concern (continued)

Significant Materials: Pipes/Materials from Chemical and Industrial Plants Potential Sources: Chemical residue, insulation, lead piping, chipped or damaged painted surfaces and protective coatings Pollutants of Concern: Chemical residue, oil, lubricants, damaged insulation (asbestos), lead, cadmium, zinc, copper
Significant Materials: Sealed containers, hydraulic cylinders Potential Sources: Leaking liquid reservoirs, containers, cylinders, misc. chemicals Pollutants of Concern: Oil, PCBs, solvents, chemical residue
Significant Materials: Salvaged Construction Materials Potential Sources: Chemical residues, oils, solvents, lubricants, damaged insulation, chipped painted surfaces and protective coatings Pollutants of Concern: Chemical residue, oily wastes, asbestos, lead, cadmium, zinc
Significant Materials: Tanks, containers, vessels, cans, drums Potential Sources: Leaking or damaged containers Pollutants of Concern: Chemical residue, oily wastes, petroleum products, heating oil
Significant Materials: Transformers (oil filled) Potential Sources: Leaking transformer housings Pollutants of Concern: PCBs, oil

[1] Institute of Scrap Recycling Industries, Inc.'s Environmental Operating Guidelines, (April 1992)

(2) **Material Processing**. The type of processes employed at a particular facility depends on the type of recyclable and waste material. Typical processes include; torch cutting, shredding, baling, briquetting, wire stripping and chopping, and compacting. Processes such as shredding and shearing reduce the bulk size of recyclable scrap and waste into a size that is more easily transportable and which allows separation into uniform grades based on

manufacturer specifications. Processes such as shredding of automotive bodies include a means of segregating materials into their ferrous and non-ferrous fractions.

(3) Segregation of Processed Materials into Uniform Grades. Processing, e.g., shearing, shredding, baling, etc, of recyclable materials is followed by its segregation into uniform grades to meet a particular manufacturer's specifications. If segregated recyclable material remains exposed to precipitation, the potential still exists for storm water contamination.

(4) Disposal of Non-recyclable Waste Materials. During recycling of scrap and waste materials, a significant fraction is non-recyclable waste materials and must be disposed. The volume or quantity of material that remains un-recyclable may be too large to permit covered storage prior to shipment. Consequently, un-recyclable waste materials may be left exposed to both precipitation and runoff and, therefore, they are a likely source of storm water pollutants.

(5) Other Operations of Concern. There are a number of activities that frequently occur at scrap and waste recycling facilities including, heavy vehicle traffic over unstabilized areas, vehicle maintenance and fueling, and material handling operations. Operations associated with the receipt, handling, and processing of scrap and waste material frequently occur over areas that are not stabilized to prevent erosion. Erosion of unstabilized soils is potentially a significant source of suspended solids in storm water runoff. For example, sampling results for total suspended solids (TSS) concentrations provided in sampling data indicated a mean concentration of 466 mg/l. Unless specific measures or controls are provided to either prevent erosion or trap the sediment, this material will be carried away in storm water runoff and eventually exit the site. Suspended solids are of significant concern given the potential amount of unstabilized area and the significant amount of particulate matter that is often produced at these facilities. Both organic and inorganic pollutants can become bound up or absorbed to suspended solids in runoff.

Some scrap and waste recycling facilities may also conduct vehicle maintenance on-site. Although many of these activities frequently occur indoors, there are specific activities which could contribute pollutants to storm water. This includes washdown of vehicle maintenance areas, leaks or spills of fuel, hydraulic fluids and oil and outdoor storage of lubricants, fluids, oils and oily rags. Fueling stations are also frequently conducted outdoors without any roof cover. Activities such as topping off fuel tanks, or overfilling storage tanks (without high-level alarms) are also activities that can cause contamination of runoff. One last activity of concern is vehicle washing which can result in accumulated residue material being discharged to a storm sewer system.

The following table highlights activities associated with vehicle maintenance and material handling that are potential sources of storm water contamination.

Table E-14.2
Other Potential Pollutant Source Activities

Activity: Material Handling Systems (forklifts, cranes, conveyors) Potential Sources: Spills and/or leaks from fueling tanks, spills/leaks from oil/hydraulic fuel reservoirs, faulty/leaking hose connections/fittings, leaking gaskets Pollutants of Concern: Accumulated particulate matter (ferrous and non-ferrous metals, plastics, rubber, other), oil/lubricants, PCBs (electrical equipment), mercury (electrical controls), lead/battery acids
Activity: Vehicle Maintenance Potential Sources: Parts cleaning, waste disposal of rags, oil filters, air filters, batteries, hydraulic fluids, transmission fluids, brake fluids, coolants, lubricants, degreasers, spent solvents Pollutants of Concern: Fuel (gas/diesel), fuel additives, oil/lubricants, heavy metals, brake fluids, transmission fluids, chlorinated solvents, arsenic
Activity: Fueling stations Potential Sources: spills and leaks during fuel transfer, spills due to "topping off" tanks, runoff from fueling areas, washdown of fueling areas, leaking storage tanks,spills of oils, brake fluids, transmission fluids, engine coolants, Pollutants of Concern: gas/diesel fuel, fuel additives, oil, lubricants, heavy metals
Activity: Vehicle & Equipment cleaning & washing Potential Sources: Washing and steam cleaning Pollutants of Concern: solvent cleaners, oil/lubricants/additives, antifreeze (ethylene glycol)

b. Waste Recycling Facilities (SIC 5093) - (Liquid Recyclable Wastes)

This sub-section applies to those facilities engaged in the reclaiming and recycling of liquid wastes such as "spent solvents", "used oil", and "used ethylene glycol" typically identified under SIC 5093. This sub-section is particularly applicable to those facilities that participated in EPA group application number 195. EPA received a single group application in this category of waste recycling facilities. The following is a profile of industrial activities

and the types of significant materials associated with facilities participating in this group activity.

Group application number 195 included 220 facilities of which 214 were classified as service centers. Service centers accumulate spent solvent, used oil and antifreeze, filter cartridges and still bottoms contaminated with dry cleaning solvents (typically perchloroethylene), and used lacquer thinner from paint gun cleaning machines. The typical service center has a total storage capacity limited to approximately 10,000 gallons in individual containers and tanks with a maximum storage capacity of 20,000 gallons each. Service centers are typically limited to a maximum of 6 tanks (a total of 120,000 gallons). Twenty (20) of the service centers also function as accumulation centers where they have a maximum storage capacity of 70,000 gallons of liquid materials in containers. None of the containers are opened except under conditions where a container begins to leak or is damaged.

The group application also included four (4) facilities that operated only as container transfer stations and do not operate storage tanks. These facilities are largely enclosed warehouses that provide secondarily-contained storage areas. Three (3) facilities were identified as used oil depots where only oily water and/or used oil are accumulated in storage tanks. Storage tanks are limited to a maximum capacity of 20,000 gallons each. Used oil is transported to the facility in tanker trucks (3,500 gallons) and shipped out in tanker trucks (7,500 gallons). The used oil is ultimately transported to a processing or re-refining facility (not covered under this permit). The following table summarizes the percentage of facilities with significant materials stored.

Table E-14.3
Significant Materials Reported in Group Application Number 195

Significant Materials	Percent of Facilities
Mineral Spirits	98%
Immersion Cleaner	98%
Dry Cleaner Solvents	98%
Paint Solvents	83%
Industrial Solvents	81%
Spent Antifreeze	59%
Used Oil	57%
Allied Products	98%

The types of materials identified in Table E-14.3 are potential sources of storm water runoff contamination. Since these materials are stored and transported in individual drums and bulk storage tanks, the potential exists for spills and/or leaks during all phases of waste transport, waste transfer, container/drum handling and shipping.

There are a number of operations at these facilities that have significant potential to release pollutants to the environment if recyclable waste materials are not managed properly. However, in response to other Federal and State environmental regulations, such as RCRA and 40 CFR 112 (Oil Pollution Prevention), facilities in this group application currently employ a range of the best management practices and structural controls that also benefit storm water quality.

(1) Pollutants Found in Storm Water Discharges. Based on data provided in the group application number 195, pollutants that were most frequently reported included total suspended solids (TSS), BOD, COD, nitrite plus nitrate, oil & grease. The following table provides a statistical summary of data provided in group application number 195.

Table E-14.4
Summary Statistics for Waste Recycling Facilities in Group Application Number 195 (SIC 5093) - (Recyclable Liquid Wastes). All values in mg/l.

Paragraph	# of Samples		Mean		Min		Max		Median		99th Percentile	
Sample Type	Grab	Comp	Grab	Comp	Grab	Comp	Grab	Comp	Grab	Comp	Grab	Comp
BOD5	22	17	18	9	2	2	94	48	5	5	79	38
COD	22	17	133	83	12	5	660	400	45	45	449	320
TSS	21	16	51	28	5	5	500	84	28	20	68	59
Nitrite + Nitrate	22	17	0.90	0.78	0.05	0.05	3.70	3.50	0.61	0.38	3.45	3.29
TKN	22	17	3.1	2.0	1.0	1.0	11.0	6.0	1.5	1.0	9.9	5.7
Oil & Grease	22	17	1.8	1.5	1.0	1.0	5.0	3.0	1.5	1.0	4.0	3.0

Table E-14.4 indicates that, with the exception of BOD and COD, average concentrations in grab and composite samples were comparable with average values reported in the NURP study (NURP did not measure oil & grease). The data also indicates that pollutants such as industrial solvents were all below detection limits (without values). In the case of oil & grease, all concentration values were below the reportable concentration of 10 mg/l (see 40 CFR 110.10 and 117.21).

(2) Waste Material Handling and Storage. Given the nature and type of materials stored and handled at these facilities, the potential exists for accidental spills and leaks. Consequently, the types of activities that occur at these facilities which could potentially

result in contamination of storm water runoff is also of concern to EPA. The following table is a list of activities which may result in a release of pollutants.

Table E-14.5
Types of Potential Pollutant-Causing Activities at Waste Recycling Facilities that Handle Liquid Recyclable Wastes

Activity: Drum/Individual Container Storage and Handling Potential Sources of Pollutants: Leaks or spills due to faulty container/drum integrity, e.g., leaking seals or ports. Container materials incompatible with waste material. Improper stacking and storage of containers. Pollutants of Concern: Mineral spirits, industrial solvents, immersion cleaners, dry cleaner solvents, paint solvents, spent antifreeze.
Activity: Return and Fill Stations Potential Sources of Pollutants: Leaks, spills, or overflows from tanker truck transfer of wastes and hose drainage. Leaking pipes, valves, pumps, worn or deteriorated gaskets or seals Pollutants of Concern: Mineral spirits, industrial solvents, immersion cleaners, dry cleaner solvents, paint solvents, spent antifreeze.
Activity: Individual Container/Drum Storage Potential Sources of Pollutants: Leaks or spills due to faulty container/drum integrity, e.g., leaking seals or ports. Improper stacking and storage of containers. Pollutants of Concern: Mineral spirits, industrial solvents, immersion cleaners, dry cleaner solvents, paint solvents, spent antifreeze.

Table E-14.5
Types of Potential Pollutant-Causing Activities at Waste Recycling Facilities that Handle Liquid Recyclable Wastes (continued)

Activity: Storage Tank Operations Potential Sources of Pollutants: Overfill of storage tanks, leaking pipes, valves, worn or deteriorated pumps seals. Leaking underground storage tanks Pollutants of Concern: Mineral spirits, industrial solvents, immersion cleaners, dry cleaner solvents, paint solvents, spent antifreeze.
Activity: Material Handling Equipment Potential Sources of Pollutants: Leaking fuel lines, worn gaskets, leaking hydraulic lines and connections. Pollutants of Concern: Fuel, hydraulic fluid, oil and grease.

3. Other Activities of Concern:

The following table highlights other types of activities that are potential sources of storm water contamination.

Table E-14.6
Other Potential Sources of Storm Water Contamination

Activity: Vehicle and Equipment Maintenance (if applicable) Potential Sources of Pollutants: Replacement of fluids such as transmission and brake fluids, antifreeze, oil and other lubricants, washdown of maintenance areas, dumping fluids down floor drains connected to storm sewer system, outside storage of fluids and oily rags and waste material. Pollutants of Concern: Oil and grease, fuel, accumulated particulate matter, antifreeze.
Activity: Vehicle or Equipment Washing (if applicable) Potential Sources of Pollutants: Wash water or steam cleaning Pollutants of Concern: Oil, detergents, chlorinated solvents, suspended solids and accumulated particulate matter.

Table E-14.7
Summary Statistics From (Part 2) Sampling Results by Industrial Sector
Industrial Sector 14

Pollutant	Grab Samples (mg/l)				Composite Samples (mg/l)				NURP Results (mg/l)		
	No.	Mean	Median	95%	No.	Mean	Median	95%	Mean	Median	90%
BOD5	130	23.49	9.00	89.00	120	24.00	9.00	88.00	12.00	9.00	15.00
COD	130	253.33	120.00	1100.00	117	203.71	110.00	700.00	82.00	65.00	140.00
Copper	102	0.77	0.26	3.00	95	0.63	0.22	2.50	0.04	0.04	0.09
Lead	103	0.85	0.21	4.00	96	0.88	0.22	3.40	0.18	0.14	0.35
NO_2+NO_3-N	129	1.78	0.62	3.30	117	5.88	0.80	12.00	0.86	0.68	1.75
Oil & Grease	135	8.95	5.00	32.00					NR	NR	NR
P, Total	127	0.81	0.30	2.20	114	0.77	0.29	1.80	0.42	0.33	0.70
pH	136	7.52	7.47	9.10					NR	NR	NR
TKN	127	3.44	2.05	11.10	114	3.38	2.20	9.20	1.90	1.50	3.30
TSS	130	437.11	148.00	2096.00	116	375.84	84.50	1700.00	180.00	100.00	300.00
Zinc	97	3.16	1.40	12.00	90	3.20	1.40	10.00	0.20	0.16	0.50

Sector 15: Steam Electric Power Generating Facilities, Including Coal Handling Areas.

The definition of storm water discharges associated with industrial activity includes point source discharges of storm water from eleven major categories of facilities, including: "...category (vii) steam electric power generating facilities." The steam electric power generating category includes facilities which are coal, oil, gas, or nuclear fired. Heat captured co-generation facilities are not covered under the definition of storm water discharge associated with industrial activity, however, dual fuel co-generation facilities are included in the definition. Ancillary facilities such as fleet centers, gas turbine stations, and substations that are not contiguous to a steam electric power generation facility are not included in this classification.

Pollutants of concern include fuel, oil, heavy metals, ammonia, chlorine, sulfuric acid, sodium hydroxide, ethylene glycol, arsenic, and solvents.

Table E-15
Summary Statistics From (Part 2) Sampling Results by Industrial Sector
Industrial Sector 15

Pollutant	Grab Samples (mg/l)				Composite Samples (mg/l)				NURP Results (mg/l)		
	No.	Mean	Median	95%	No.	Mean	Median	95%	Mean	Median	90%
BOD5	76	5.71	4.25	20.00	78	5.69	4.00	20.00	12.00	9.00	15.00
COD	76	104.02	32.50	360.00	77	69.47	39.50	280.00	82.00	65.00	140.00
Copper	70	0.08	0.00	0.21	75	0.03	0.02	0.13	0.04	0.04	0.09
Lead	28	0.02	0.00	0.08	23	0.02	0.01	0.07	0.18	0.14	0.35
NO_2+NO_3-N	76	5.62	0.36	3.70	77	0.75	0.45	3.20	0.86	0.68	1.75
Oil & Grease	88	1.38	0.00	6.00					NR	NR	NR
P, Total	75	0.79	0.29	3.09	78	0.63	0.27	3.10	0.42	0.33	0.70
pH	70	7.32	7.42	8.28					NR	NR	NR
TKN	76	2.41	1.25	8.55	78	1.95	1.00	10.00	1.90	1.50	3.30
TSS	76	516.25	44.00	1200.00	77	212.35	40.00	810.00	180.00	100.00	300.00
Zinc	35	0.32	0.05	0.66	39	0.27	0.06	0.92	0.20	0.16	0.50

Sector 16: Motor Freight Transportation Facilities, Passenger Transportation Facilities, Rail Transportation Facilities, and United States Postal Service Transportation Facilities

The definition of storm water discharges associated with industrial activity includes point source discharges of storm water from eleven major categories of facilities, including: "...category (viii) facilities classified as Standard Industrial Classification (SIC) codes 40, 41, 42 (except 4221-25), 43, 44, and 5171 that have vehicle and equipment maintenance shops, or equipment cleaning operations." The category further states that only those portions of the facility that are either involved in vehicle and equipment maintenance (including vehicle and equipment rehabilitation, mechanical repairs, painting, fueling, and lubrication) or equipment cleaning operations are associated with industrial activity.

Vehicle and equipment maintenance is a broad term used to include the following activities: vehicle and equipment fluid changes, mechanical repairs, parts cleaning, sanding, refinishing, painting, fueling, locomotive sanding (loading sand for traction), storage of vehicles and equipment waiting for repair or maintenance, and storage of the related materials and waste materials, such as oil, fuel, batteries, tires, or oil filters. Equipment cleaning operations include areas where the following types of activities take place: vehicle exterior wash down, interior trailer washouts, tank washouts, and rinsing of transfer equipment.

SIC code 40 includes facilities primarily engaged in furnishing transportation by line-haul railroad, and switching and terminal establishments. The following types of facilities are examples of those covered under SIC code 40: electric railroad line-haul operation, railroad line-haul operation, interurban railways, beltline railroads, logging railroads, railroad terminals, and stations operated by railroad terminal companies.

SIC code 41 includes facilities primarily engaged in furnishing local and suburban transportation, such as those providing transportation in and around a municipality by bus, rail, or subway. The following types of facilities are examples of those covered under SIC code 41: bus line operations, airport transportation services (road or rail), cable car operations, subway operations, ambulance services, sightseeing buses, van pool operations, limousine rental with drivers, taxicab operations, and school buses not operated by the educational institution.

SIC code 42 includes facilities providing local or long-distance trucking, transfer, and/or storage services. The following types of facilities are examples of those covered under SIC code 42: hauling by dump truck, trucking timber, contract mail carriers, furniture moving, garbage collection without disposal, over-the-road trucking, long distance trucking, and freight trucking terminal.

SIC code 43 includes all establishments of the United States Postal Service.

SIC code 5171 includes establishments engaged in the wholesale distribution of crude petroleum and petroleum products from bulk liquid storage facilities.

Significant materials include oily rags, air filters, batteries, hydraulic fluids, paints, and vehicles awaiting service.

Pollutants include fuel, oil, heavy metals, chlorinated solvents, acid/alkaline wastes, ethylene glycol, arsenic, heavy metals, organics, hydraulic fluids, dust, paint solids, sediment, detergents, phosphorus, salts, suspended solids, and biochemical oxygen demand (BOD).

Table E-16
Summary Statistics From (Part 2) Sampling Results by Industrial Sector
Industrial Sector 16

Pollutant	Grab Samples (mg/l)				Composite Samples (mg/l)				NURP Results (mg/l)		
	No.	Mean	Median	95%	No.	Mean	Median	95%	Mean	Median	90%
BOD5	116	11.29	6.00	34.00	105	9.27	6.00	28.00	12.00	9.00	15.00
COD	117	318.10	118.00	781.00	102	189.46	89.00	489.00	82.00	65.00	140.00
Copper									0.04	0.04	0.09
Lead									0.18	0.14	0.35
NO_2+NO_3-N	118	1.59	0.92	6.07	102	1.41	0.78	4.26	0.86	0.68	1.75
Oil & Grease	118	9.56	0.00	27.00					NR	NR	NR
P, Total	118	1.47	0.54	8.10	102	0.92	0.45	3.05	0.42	0.33	0.70
pH	114	7.30	7.40	8.80					NR	NR	NR
TKN	118	3.75	1.50	13.40	102	2.48	1.40	8.80	1.90	1.50	3.30
TSS	118	517.01	171.50	2800.00	102	248.51	89.50	917.00	180.00	100.00	300.00
Zinc	1	0.14	0.14	0.14	1	0.28	0.28	0.28	0.20	0.16	0.50

Sector 17: Vehicle and Equipment Maintenance and Cleaning Operations

The definition of storm water discharge associated with industrial activity includes point source discharges of storm water from eleven major categories of facilities, including: "...category (viii) transportation facilities classified as Standard Industrial Classification (SIC) codes 40, 41, 42 (except 4221-25), 43, 44, 45, and 5171 that have vehicle and equipment maintenance shops, equipment cleaning operations, or airport deicing operations."

SIC code 41 includes facilities primarily engaged in furnishing local and suburban transportation, such as those providing transportation in and around a municipality by bus, rail, or subway. The following types of facilities are examples of those covered under SIC code 41: bus line operation, airport transportation service (road or rail), cable car operation, subway operation, ambulance service, sightseeing buses, van pool operation, limousine rental with drivers, taxicab operation, and school buses not operated by the educational institution.

SIC code 42 includes facilities providing local or long-distance trucking, transfer, and/or storage services. The following types of facilities are examples of those covered under SIC code 42: hauling by dump truck, trucking timber, contract mail carriers, furniture moving, garbage collection without disposal, over-the-road trucking, long distance trucking, and freight trucking terminal.

SIC code 43 includes all establishments of the United States Postal Service.

SIC code 5171 includes establishments engaged in the wholesale distribution of crude petroleum and petroleum products from bulk liquid storage facilities.

Vehicle and equipment maintenance is a broad term used to include the following activities: vehicle and equipment fluid changes, mechanical repairs, parts cleaning, sanding, refinishing, painting, fueling, storage of vehicles and equipment waiting for repair or maintenance, and storage of the related materials and waste materials, such as oil, fuel, batteries, or oil filters. Equipment cleaning operations include areas where the following types of activities take place: vehicle exterior wash down, interior trailer washouts, tank washouts, and rinsing of transfer equipment.

Significant materials include oils, washing equipment, used equipment, vehicle parts, vehicles, fuels, paint, waste rags, oil filters, storage tanks, and detergents. Pollutants from these facilities include fuel, oil, heavy metals, organics, solvents, suspended solids, phosphorus, salts, acid/alkaline wastes and arsenic.

Table E-17
Summary Statistics From (Part 2) Sampling Results by Industrial Sector
Industrial Sector 17

Pollutant	Grab Samples (mg/l)				Composite Samples (mg/l)				NURP Results (mg/l)		
	No.	Mean	Median	95%	No.	Mean	Median	95%	Mean	Median	90%
BOD5	400	17.11	8.00	60.50	376	11.07	6.00	41.00	12.00	9.00	15.00
COD	408	135.16	63.95	498.00	374	85.64	48.00	250.00	82.00	65.00	140.00
Copper	19	0.02	0.01	0.06	20	0.02	0.01	0.08	0.04	0.04	0.09
Lead	32	0.03	0.01	0.11	31	0.01	0.00	0.06	0.18	0.14	0.35
NO_2+NO_3-N	399	2.99	0.61	9.00	372	1.99	0.52	5.10	0.86	0.68	1.75
Oil & Grease	418	16.38	2.80	41.00					NR	NR	NR
P, Total	405	1.12	0.33	3.90	373	0.73	0.29	2.91	0.42	0.33	0.70
pH	380	7.13	7.26	8.89					NR	NR	NR
TKN	405	2.69	1.40	7.70	373	2.04	1.13	6.30	1.90	1.50	3.30
TSS	406	503.15	104.00	1890.00	375	454.20	67.00	1100.00	180.00	100.00	300.00
Zinc	30	0.23	0.13	1.10	28	1.34	0.11	0.66	0.20	0.16	0.50

Sector 18: Water Transportation Facilities, Vehicle Maintenance/Equipment Cleaning Operations

The definition of storm water discharges associated with industrial activity includes point source discharges of storm water from eleven major categories of facilities, including: ...category (viii) water transportation facilities classified as Standard Industrial Classification (SIC) code 44 that have vehicle maintenance shops and/or equipment cleaning operations. The category further states that only those portions of the facility that are either involved in vehicle and equipment maintenance (including vehicle and equipment rehabilitation, mechanical repairs, painting, fueling, and lubrication), or equipment cleaning operations are associated with industrial activity. Vehicle and equipment maintenance is a broad term used to include the following activities: vessel and equipment fluid changes, mechanical repairs, parts cleaning, sanding, blasting, welding, refinishing, painting, fueling, storage of the related materials and waste materials, such as oil, fuel, batteries, or oil filters. Equipment cleaning operations include areas where vessel and vehicle exterior washdown occurs.

SIC code 44 includes facilities primarily engaged in furnishing water transportation services. The following types of facilities are examples of those covered under SIC code 44:

- Deep Sea Foreign Transportation of Freight (SIC 4412)
- Deep Sea Domestic Transportation of Freight (SIC 4424)
- Freight Transportation on the Great Lakes - St. Lawrence Seaway (SIC 4432)
- Water Transportation of Freight, Not Elsewhere Classified (SIC 4449)
- Deep Sea Transportation of Passengers, Except by Ferry (SIC 4481)
- Ferries (SIC 4482)
- Marine Cargo Handling (SIC 4491)
- Towing and Tugboat Services (SIC 4492)
- Marinas (SIC 4493)
- Water Transportation Services, Not Elsewhere Classified (SIC 4499)

Pollutants of concern include paint solids, heavy metals, suspended solids, spent abrasives, solvents, dust, paint, paint thinner, spent solvents, dust, oil, ethylene glycol, acid/alkaline wastes, detergents, fuel, trash, petroleum products, sanitary waste bilge & ballast water, biochemical oxygen demand (BOD), and bacteria.

Table E-18
Summary Statistics From (Part 2) Sampling Results by Industrial Sector
Industrial Sector 18

Pollutant	Grab Samples (mg/l)				Composite Samples (mg/l)				NURP Results (mg/l)		
	No.	Mean	Median	95%	No.	Mean	Median	95%	Mean	Median	90%
BOD5	15	8.60	7.00	39.00	14	6.00	6.00	11.00	12.00	9.00	15.00
COD	15	130.93	93.00	500.00	14	75.79	50.50	203.00	82.00	65.00	140.00
Copper									0.04	0.04	0.09
Lead	4	0.20	0.05	0.70	3	0.10	0.10	0.10	0.18	0.14	0.35
NO_2+NO_3-N	15	4.23	0.60	54.00	14	0.66	0.65	1.61	0.86	0.68	1.75
Oil & Grease	15	11.93	2.00	96.00					NR	NR	NR
P, Total	15	0.27	0.10	1.20	14	0.15	0.17	0.32	0.42	0.33	0.70
pH	15	7.14	7.00	8.80					NR	NR	NR
TKN	15	2.64	1.60	16.00	14	9.41	0.75	118.00	1.90	1.50	3.30
TSS	15	633.80	135.00	4330.00	14	224.14	67.50	944.00	180.00	100.00	300.00
Zinc	4	0.68	0.22	2.20	3	0.42	0.21	0.87	0.20	0.16	0.50

Sector 19: Ship Building & Repairing and Boat Building & Repairing Facilities

The definition of storm water discharges associated with industrial activity includes point source discharges of storm water from eleven major categories of facilities, including: "...category (ii) facilities classified as Standard Industrial Classification (SIC) code 373." SIC code 373 includes facilities primarily engaged in ship and boat building and repairing services, and include the following:

- **Ship Building and Repairing (SIC code 3731).** These are establishments primarily engaged in building and repairing ships, barges, and lighters, whether self-propelled or towed by other crafts. The industry also includes the conversion and alteration of ships and the manufacture of off-shore oil and gas well drilling and production platforms (whether of not self-propelled). Examples include building and repairing of barges, cargo vessels, combat ships, crew boats, dredges, ferryboats, fishing vessels, lighthouse tenders, naval ships, offshore supply boats, passenger-cargo vessels, patrol boats, sailing vessels, towboats, trawlers, and tugboats.

- **Boat Building and Repairing (SIC code 3732).** These facilities are primary engaged in building and repairing boats. Examples include building and repairing of fiberglass boats, motor-boats, sailboats, rowboats, canoes, dinghies, dories, small fishing boats, houseboats, kayaks, lifeboats, pontoons, and skiffs.

Pollutants of concern include spent abrasives, solvents, dust, oil, ethylene glycol, acid/alkaline wastes, detergents, paint solids, heavy metals, spent solvents, biochemical oxygen demand (BOD), bacteria, suspended solids.

Table E-19
Summary Statistics From (Part 2) Sampling Results by Industrial Sector
Industrial Sector 19

	Grab Samples (mg/l)				Composite Samples (mg/l)				NURP Results (mg/l)		
Pollutant	No.	Mean	Median	95%	No.	Mean	Median	95%	Mean	Median	90%
BOD5	44	5.00	2.80	15.00	37	7.40	0.90	23.00	12.00	9.00	15.00
COD	51	73.22	53.00	260.00	43	68.80	28.00	240.00	82.00	65.00	140.00
Copper	5	0.16	0.15	0.32	5	0.08	0.09	0.13	0.04	0.04	0.09
Lead	6	0.75	0.04	4.24	5	11.00	0.06	0.33	0.18	0.14	0.35
NO_2+NO_3-N	51	0.79	0.72	1.60	45	0.85	0.72	1.80	0.86	0.68	1.75
Oil & Grease	52	0.98	0.00	5.00					NR	NR	NR
P, Total	51	0.21	0.00	0.91	45	0.88	0.00	0.76	0.42	0.33	0.70
pH	43	7.20	7.30	8.11					NR	NR	NR
TKN	51	1.19	1.00	2.40	43	2.20	0.97	3.90	1.90	1.50	3.30
TSS	51	92.33	17.00	505.00	45	2.36	8.00	200.00	180.00	100.00	300.00
Zinc	2	0.31	0.31	0.36	1	39.00	0.33	0.33	0.20	0.16	0.50

Sector 20: Vehicle Maintenance Areas, Equipment Cleaning Areas, or Deicing Areas Located at Air Transportation Facilities

The definition of storm water discharges associated with industrial activity includes point source discharges of storm water from eleven major categories of facilities, including: "... category (viii) facilities classified as Standard Industrial Classification (SIC) 45 that have vehicle and equipment maintenance shops, equipment cleaning operations, or airport deicing operations." Only those portions of the facility that are either involved in vehicle and equipment maintenance (including vehicle and equipment rehabilitation, mechanical repairs, painting, fueling, and lubrication), equipment cleaning operations, or airport deicing operations are considered associated with industrial activity. SIC code 45 generally applies to airports, airport terminals and flying fields. Industrial activities include the following:

Aircraft Deicing includes both deicing to remove frost, snow or ice, and anti-icing which prevents the accumulation of frost, snow or ice. Deicing of an airplane is accomplished through the application of a freezing point depressant fluid, commonly ethylene glycol or propylene glycol, to the exterior surface of an airplane. Both ethylene and propylene glycol have high biochemical oxygen demands (BOD) when discharged to receiving waters. Environmental impacts on surface waters due to glycol discharges includes glycol odors and glycol contaminated surface water and ground water systems, diminished dissolved oxygen levels and fish kills.

Runway Deicing/Anti-icing activities include deicing/anti-icing operations conducted on runways, taxiways and ramps. Runway deicing/anti-icing commonly involves either the application of chemical fluids such as ethylene glycol or propylene glycol, or solid constituents such as pelletized urea. Urea has a high nitrogen content, therefore degradation of urea in a receiving water causes an increase in nutrient loadings resulting in an accelerated growth of algae and eutrophic conditions. Under certain ambient conditions, the degradation of urea in receiving waters can also result in ammonia concentrations toxic to aquatic life.

Aircraft, Ground Vehicle and Equipment Maintenance and Washing. Maintenance activities included in this section include both minor and major operations conducted either on the apron adjacent to the passenger terminal, or at dedicated maintenance facilities. Potential pollutant sources from all types of maintenance activities includes spills and leaks of engine oils, hydraulic fluids, transmission oil, radiator fluids, and chemical solvents used for parts cleaning. In addition, the disposal of waste parts, batteries, oil and fuel filters, and oily rags also have a potential for contaminating storm water runoff from maintenance areas unless proper management practices and operating procedures are implemented. The spent wash water from aircraft and ground vehicle washing activities could potentially be contaminated with surface dirt, metals, and fluids (fuel, hydraulic fluid, oil, lavatory waste).

Runway Maintenance. Over time, materials such as tire rubber, oil and grease, paint chips, and jet fuel can buildup on the surface of a runway causing a reduction in the friction of the pavement surface. When the friction level of the runway falls below a specific level, then maintenance on the runway must be performed. The Federal Aviation Administration (FAA)

recommends several methods for removing rubber deposits and other contaminants from a runway surface including high pressure water, chemical solvents, high velocity particle impact, and mechanical grinding. If not properly managed, the materials removed from the runway surface could be discharged into nearby surface waters. Similarly, if chemical solvents are used in the maintenance operation, improper management practices could result in discharges of the chemical solvents in the storm water runoff from runway areas to nearby surface waters.

Table E-20
Summary Statistics From (Part 2) Sampling Results by Industrial Sector
Industrial Sector 20

	Grab Samples (mg/l)				Composite Samples (mg/l)				NURP Results (mg/l)		
Pollutant	No.	Mean	Median	95%	No.	Mean	Median	95%	Mean	Median	90%
BOD5	96	23.95	7.50	42.00	89	21.34	5.30	41.40	12.00	9.00	15.00
COD	95	81.49	44.00	286.00	88	75.63	36.00	182.00	82.00	65.00	140.00
Copper	2	0.03	0.03	0.04	3	0.01	0.01	0.02	0.04	0.04	0.09
Lead	2	0.02	0.02	0.03	3	0.00	0.00	0.00	0.18	0.14	0.35
NO_2+NO_3-N	75	1.27	0.41	7.90	65	1.29	0.43	7.70	0.86	0.68	1.75
Oil & Grease	98	4.66	1.85	20.00					NR	NR	NR
P, Total	86	0.44	0.20	1.84	79	0.29	0.20	0.88	0.42	0.33	0.70
pH	94	7.23	7.60	8.30					NR	NR	NR
TKN	95	19.79	1.58	27.00	88	16.00	1.40	18.80	1.90	1.50	3.30
TSS	96	184.73	29.00	1080.00	87	79.59	22.00	258.00	180.00	100.00	300.00
Zinc	8	0.14	0.08	0.58	3	0.35	0.04	1.00	0.20	0.16	0.50

Sector 22: Domestic Wastewater Treatment Plants

The definition of storm water discharge associated with industrial activity includes point source discharges from eleven major categories of facilities, including: "...category (ix) treatment works treating domestic sewage or any other sewage sludge or wastewater treatment device or system, used in the storage treatment, recycling, and reclamation of municipal or domestic sewage, including land dedicated to the disposal of sewage sludge that are located within the confines of the facility, with a design flow of 1.0 mgd or more or required to have an approved pretreatment program under 40 CFR part 403." This category does not includes farm lands, domestic gardens or lands used for sludge management where beneficially reused which are not physically located in the confines of the facility, or areas that are in compliance with section 405 of the CWA.

Pollutants of concern include diesel, gasoline, petroleum products other than fuels: numerous grades of motor oils, gear and chassis lubricants, turbine oils, grease and hydraulic fluids, acid/alkaline wastes, arsenic, organics, chlorinated ethylene glycol, acids and bases for pH adjustments, disinfectants, polymers and coagulants, alum, ferric chloride, soda ash, lime, methanol, sodium aluminate, sodium hypochlorite, sodium hydrochloride mineral spirits, acetone, paint thinner, and lacquer thinner, toluene, TCE, isopropandlamine, and methyl-ethyl-ketone, dust, paint solids, paint, spent chlorinated solvents, commercial brands of balance fertilizers (6-6-6, 8-8-8 or 12-12-12), commercial sludge based products, fuel, process chemicals, diazanon, malathion, amdro, dimethylphthalate, diethyl phthalate, dichlorvos, carbaryl, skeetal, batex, liquid copper, bacteria, biochemical oxygen demand (BOD), suspended solids, oil, heavy metals, chlorinated solvents, ethylene glycol, detergents, metals, phosphorous.

Table E-22
Summary Statistics From (Part 2) Sampling Results by Industrial Sector
Industrial Sector 22

Pollutant	Grab Samples (mg/l)				Composite Samples (mg/l)				NURP Results (mg/l)		
	No.	Mean	Median	95%	No.	Mean	Median	95%	Mean	Median	90%
BOD5	90	33.26	11.50	53.40	89	46.11	8.00	200.00	12.00	9.00	15.00
COD	84	133.03	68.65	410.00	84	157.95	61.59	880.00	82.00	65.00	140.00
Copper	28	0.07	0.01	0.22	27	0.05	0.02	0.11	0.04	0.04	0.09
Lead	27	0.03	0.00	0.15	26	0.01	0.00	0.09	0.18	0.14	0.35
NO_2+NO_3-N	84	20.86	1.09	136.00	83	20.50	0.87	131.27	0.86	0.68	1.75
Oil & Grease	89	24.24	0.90	26.00					NR	NR	NR
P, Total	86	0.95	0.50	3.17	84	0.68	0.45	1.89	0.42	0.33	0.70
pH	82	6.80	6.98	7.83					NR	NR	NR
TKN	79	8.10	1.52	18.00	78	4.74	1.33	11.00	1.90	1.50	3.30
TSS	90	160.17	68.10	575.00	88	114.44	55.50	414.00	180.00	100.00	300.00
Zinc	23	0.23	0.06	0.75	22	0.12	0.06	0.43	0.20	0.16	0.50

Sector 23: Food and Kindred Products Manufacturing Facilities

The definition of storm water discharges associated with industrial activity includes point source discharges of storm water from eleven major categories of facilities, including: "...category (xi) facilities under Standard Industrial Classification (SIC) codes 20, 21 ..."

- Meat Products (SIC Codes 2011, 2013, and 2015)
- Dairy Products (SIC Codes 2021, 2022, 2023, 2024, and 2026)
- Canned, Frozen, and Preserved Fruits, Vegetables, and Food Specialties (SIC Codes 2032, 2033, 2034, 2035, 2037, and 2038)
- Grain Mill Products (SIC Codes 2041, 2043, 2044, 2045, 2046, 2047, and 2048)
- Bakery Products (SIC Codes 2051, 2052, and 2053)
- Sugar and Confectionery Products (SIC Codes 2061, 2062, 2063, 2064, 2066, 2067, and 2068)
- Fats and Oils (SIC Codes 2074, 2075, 2076, 2077, and 2079)
- Beverages (SIC Codes 2082, 2083, 2084, 2085, 2086, and 2087)
- Miscellaneous Food Preparations and Kindred Products (SIC Codes 2091, 2092, 2095, 2096, 2097, 2098, and 2099)
- Tobacco Products (SIC Codes 2111, 2121, 2131, and 2141).

Meat Products (SIC Code 201X) - Production related activities include stockyards, slaughtering (killing, blood processing, viscera handling, and hide processing), cutting and deboning, meat processing, rendering, and materials recovery.

Dairy Products (SIC Code 202X) - Typical operations may include: culturing, churning, pressing, curing, blending, condensing, sweetening, drying, milling, and packaging.

Canned, Frozen, and Preserved Fruits, Vegetables, and Frozen Specialties (SIC Code 203X) -Fruits and vegetables are washed, cut, blanched, and cooked prior to being classified as finished product. Additional operations may include drying, dehydrating, and freezing.

Grain Mills (SIC Code 204X) - Process operations performed in the grain mill subsector include: washing, milling, debranning, heat treatment (i.e., steeping, parboiling, drying and cooking), screening, shaping (i.e., extruding, grinding, molding, and flaking), and vitamin and mineral supplementing.

Bakery Products (SIC Code 205X) - Process operations in this subsector include mixing, shaping of dough, cooling, and decorating.

Sugar and Confectionery (SIC Code 206X) - Typical processes include mixing, cooking, and then forming using various techniques. The manufacture of chocolate products requires shelling, roasting, and grinding of the cocoa beans followed by the typical processing operations.

Fats and Oils (SIC Code 207X) Typical process operations at an animal and marine fats and oils facility include cooking of inedible fats and oils. Operations at an edible oils manufacturer include refining, bleaching, hydrogenation, fractionation, emulsification, deodorization, filtration, and blending of the crude oils into edible products.

Beverages (SIC Code 208X) - Process operations may include brewing, distilling, fermentation, blending, and packaging (i.e., bottling, canning, or bulk packaging).

Miscellaneous Food Preparation and Kindred Products (SIC Code 209X) - Process operations may include shelling, washing, drying, shaping, baking, frying, and seasoning.

Tobacco Products (SIC Code 21XX) - Typical process operations may include drying, blending, shaping, cutting and rolling.

Significant materials exposed to storm water at food and kindred products manufacturing facilities consist mostly of food products or byproducts and include acids (phosphoric, sulfuric), activated carbon, ammonia, animal cages, bleach, blood, bone meal, brewing residuals, calcium oxide, carbon dioxide, caustic soda, chlorine, cheese, coke oven tar, detergent, eggs, ethyl alcohol, fats (greases, shortening, oils), feathers, feed, ferric chloride, fruits, vegetables, coffee beans, gel bone, grain (flour, oats, wheat), hides, lard, manure, milk, salts (brine), skim powder, starch, sugar (sweetener, honey, fructose, syrup), tallow, wastes (off-spec product, sludge), whey, and yeast.

The pollutants of concern are biological oxygen demand (BOD_5), total suspended solids (TSS), oil and grease, pH, and chemicals from applications of pesticides.

Table E-23
Summary Statistics From (Part 2) Sampling Results by Industrial Sector
Industrial Sector 23

Pollutant	Grab Samples (mg/l)				Composite Samples (mg/l)				NURP Results (mg/l)		
	No.	Mean	Median	95%	No.	Mean	Median	95%	Mean	Median	90%
BOD5	298	51.15	13.90	206.00	287	42.54	11.00	180.00	12.00	9.00	15.00
COD	296	192.46	77.00	745.00	286	141.65	63.00	463.00	82.00	65.00	140.00
Copper	17	0.08	0.04	0.27	17	0.05	0.03	0.24	0.04	0.04	0.09
Lead	12	0.01	0.01	0.03	10	0.01	0.01	0.04	0.18	0.14	0.35
NO_2+NO_3-N	301	1.17	0.56	3.70	289	0.98	0.55	3.60	0.86	0.68	1.75
Oil & Grease	300	5.35	1.05	20.95					NR	NR	NR
P, Total	298	5.13	0.56	9.06	287	1.32	0.48	5.96	0.42	0.33	0.70
pH	286	7.06	7.10	8.40					NR	NR	NR
TKN	300	4.95	2.35	18.00	290	4.07	2.00	17.00	1.90	1.50	3.30
TSS	298	252.39	72.50	1320.00	286	200.06	53.50	900.00	180.00	100.00	300.00
Zinc	33	0.78	0.21	2.10	31	0.79	0.24	5.83	0.20	0.16	0.50

Sector 24: Textile Mills, Apparel and other Fabric Product Manufacturing Facilities

The definition of storm water discharges associated with industrial activity includes point source discharges of storm water from eleven major categories of facilities, including: "...category (xi) facilities under Standard Industrial Classification (SIC) code 22." Storm water discharges from the following activities are covered: Textile Mill Products, of and regarding facilities and establishments engaged in the preparation of fiber and subsequent manufacturing of yarn, thread, braids, twine, and cordage, the manufacturing of broadwoven fabrics, narrow woven fabrics, knit fabrics, and carpets and rugs from yarn; processes involved in the dyeing and finishing of fibers, yarn fabrics, and knit apparel; the integrated manufacturing of knit apparel and other finished articles of yarn; the manufacturing of felt goods (wool), lace goods, nonwoven fabrics, and miscellaneous textiles.

Pollutants of concern include biochemical oxygen demand (BOD5), total suspended solids (TSS), pH, total chromium, total aluminum, total copper, total lead, total zinc, COD, phenols, sulfides, oil and grease, and benzene.

Table E-24
Summary Statistics From (Part 2) Sampling Results by Industrial Sector
Industrial Sector 24

	Grab Samples (mg/l)				Composite Samples (mg/l)				NURP Results (mg/l)		
Pollutant	No.	Mean	Median	95%	No.	Mean	Median	95%	Mean	Median	90%
BOD5	110	11.41	7.75	38.00	107	9.82	7.00	29.00	12.00	9.00	15.00
COD	110	69.19	44.00	228.00	107	48.05	37.00	111.00	82.00	65.00	140.00
Copper	16	0.03	0.01	0.15	14	0.07	0.01	0.61	0.04	0.04	0.09
Lead	8	0.07	0.02	0.28	7	0.04	0.03	0.11	0.18	0.14	0.35
NO_2+NO_3-N	110	1.33	0.39	2.50	107	1.14	0.39	1.87	0.86	0.68	1.75
Oil & Grease	111	2.94	0.00	14.00					NR	NR	NR
P, Total	110	0.35	0.14	0.66	107	0.31	0.11	0.60	0.42	0.33	0.70
pH	105	6.72	6.85	8.60					NR	NR	NR
TKN	110	2.72	1.70	6.50	107	1.92	1.50	5.40	1.90	1.50	3.30
TSS	110	126.22	35.50	410.00	107	80.04	22.00	380.00	180.00	100.00	300.00
Zinc	6	0.33	0.19	1.06	14	0.30	0.21	0.88	0.20	0.16	0.50

Sector 25: Wood and Metal Furniture and Fixture Manufacturing Facilities

The definition of storm water discharges associated with an industrial activity includes point source discharges of storm water from eleven major categories of facilities, including: "...category (xi) facilities classified as Standard Industrial Classification (SIC) codes 2434 and 25." Furniture and fixture manufacturing facilities eligible for coverage include facilities identified by the following SIC codes:

- Wood Kitchen Cabinets (SIC Code 2434)
- Household Furniture (SIC Code 251)
- Office Furniture (SIC Code 252)
- Public Buildings and Related Furniture (SIC Code 253)
- Partitions, Shelving, Lockers, and Office and Store Fixtures (SIC Code 254)
- Miscellaneous Furniture and Fixtures (SIC Code 259).

The process of manufacturing wood furniture begins with the delivery and storage of wood. There are three different raw wood materials, lumber, veneer, and particle board. Once delivered, raw lumber is allowed to air dry up to one year. After the lumber is sufficiently air dried it is then transported to a dry kiln for further drying. Once the lumber has been dried to a desired moisture content, the dried lumber is taken to the processing area. The remaining furniture manufacturing processes are all completed indoors, including cutting, planing, sanding, finishing, and lathing.

Veneer is another raw material used in the production of furniture. In this process logs are placed in a steam vat to increase moisture content. The logs are turned on a lathe to peel off the veneer. The resulting veneer sheets are layered into stacks or "hacks." Moisture is removed from the hacks by kiln drying. After a desired moisture content has been achieved the hacks are disassembled.

Particle board is the third raw material incorporated into the manufacturing of wood furniture. The board is received, cut to size, and banded on all four edges with solid wood. The banding is accomplished in continuous, steam heated units utilizing adhesives. The panels are allowed to cool and then they are sanded.

The significant materials identified as exposed to storm water at wood furniture and fixture manufacturing facilities include raw wood, sawdust, coal, kiln ash, solvent-based finishing materials and waste products, used rags, raw glue and waste materials, and petroleum-based products.

Metal furniture manufacturing facilities may purchase wood pieces ready for assembly or they may have all the industrial activities of wood manufacturing facilities in addition to the metal manufacturing facilities. Facilities that manufacture metal household furniture maintain all operations including: machining and assembly, finishing, and temporary storage of finished products within an enclosed building. Cold roll steel is initially received and temporarily stored within the manufacturing building. However, steel may be stored outside

prior to use. The steel is cut to size, bent, and welded to design specifications to fabricate raw metal household furniture. Final grinding, sanding, finishing, spot welding, and painting are then completed.

The significant materials identified as exposed to storm water at metal furniture and fixture facilities include metals, sawdust, solvent-based finishing materials and waste products, electroplating solutions and sludges, used rags, raw glue and waste materials, and petroleum-based products.

Pollutants at wood and metal furniture manufacturing facilities include TSS, pH, cadmium, arsenic, COD, BOD_5, lead, solvents, oil & grease, diesel fuel, and gasoline.

Table E-25
Summary Statistics From (Part 2) Sampling Results by Industrial Sector
Industrial Sector 25

Pollutant	Grab Samples (mg/l)				Composite Samples (mg/l)				NURP Results (mg/l)		
	No.	Mean	Median	95%	No.	Mean	Median	95%	Mean	Median	90%
BOD5	25	12.22	9.00	44.00	24	8.80	5.95	26.00	12.00	9.00	15.00
COD	25	95.96	83.00	230.00	24	76.33	72.50	180.00	82.00	65.00	140.00
Copper	4	0.04	0.04	0.07	4	0.00	0.00	0.02	0.04	0.04	0.09
Lead	3	0.08	0.06	0.16	3	0.01	0.01	0.02	0.18	0.14	0.35
NO_2+NO_3-N	25	1.73	0.90	6.20	24	1.51	0.68	5.60	0.86	0.68	1.75
Oil & Grease	25	3.84	0.00	14.00					NR	NR	NR
P, Total	25	0.27	0.20	0.89	24	0.26	0.19	0.71	0.42	0.33	0.70
pH	23	7.54	7.50	8.90					NR	NR	NR
TKN	25	4.37	1.70	15.00	24	4.40	1.35	13.00	1.90	1.50	3.30
TSS	25	187.83	130.00	440.00	24	142.88	90.50	550.00	180.00	100.00	300.00
Zinc	4	2.97	0.78	10.00	4	0.59	0.40	1.50	0.20	0.16	0.50

Sector 26: Printing and Publishing Facilities

The definition of storm water discharges associated with industrial activity includes point source discharges of storm water from eleven major categories of facilities, including: "...category (xi) facilities classified as Standard Industrial Classification (SIC) Code 27 which includes facilities primarily engaged in printing and publishing services. The following facilities are covered under SIC code 27:

- **Book Printing (SIC Code 2732)**: Establishments primarily engaged in printing, or in printing and binding, books and pamphlets, but not engaged in publishing.

- **Commercial Printing, Lithographic (SIC Code 2752)**: Establishments primarily engaged in printing by the lithographic process. Offset printing, photo-offset printing, and photolithographing are also included in this industry.

- **Commercial Printing, Gravure (SIC Code 2754)**: Establishments primarily engaged in gravure printing.

- **Commercial Printing, Not Elsewhere Classified (SIC Code 2759)**: Establishments primarily engaged in commercial or job printing. This industry includes general printing shops, as well as shops specializing in printing newspapers and periodicals for others.

- **Platemaking and Related Services (SIC Code 2796)**: Establishments primarily engaged in making plates for printing purposes and in related services. Also included are establishments primarily engaged in making positive or negatives from which offset lithographic plates are made.

Pollutants of concern include toxic waste ink with solvents chromium, lead, dust, sludge, ink - sludges with chromium or lead, solvents, photographic processing wastes, fuel, oil, heavy metals, trash, and petroleum products.

Table E-26
Summary Statistics From (Part 2) Sampling Results by Industrial Sector
Industrial Sector 26

Pollutant	Grab Samples (mg/l)				Composite Samples (mg/l)				NURP Results (mg/l)		
	No.	Mean	Median	95%	No.	Mean	Median	95%	Mean	Median	90%
BOD5	27	10.99	9.00	49.00	27	6.95	6.40	22.20	12.00	9.00	15.00
COD	27	57.19	49.00	176.00	27	42.37	39.00	119.00	82.00	65.00	140.00
Copper	7	0.03	0.03	0.08	6	0.02	0.03	0.04	0.04	0.04	0.09
Lead	1	0.03	0.03	0.03	0				0.18	0.14	0.35
NO_2+NO_3-N	20	1.27	0.82	4.00	20	1.35	1.05	4.49	0.86	0.68	1.75
Oil & Grease	27	12.58	2.50	56.00					NR	NR	NR
P, Total	27	0.37	0.14	1.50	27	0.35	0.13	1.30	0.42	0.33	0.70
pH	20	7.07	7.03	8.46					NR	NR	NR
TKN	27	3.13	1.50	10.00	27	1.57	0.84	4.60	1.90	1.50	3.30
TSS	27	91.52	30.00	433.00	27	30.83	28.00	82.00	180.00	100.00	300.00
Zinc	4	0.48	0.37	1.00	3	0.47	0.52	0.65	0.20	0.16	0.50

Sector 27: Rubber, Miscellaneous Plastic Products, and Miscellaneous Manufacturing Industries

The definition of storm water discharges associated with industrial activity includes point source discharges of storm water from eleven major categories of facilities, including: "... (xi) facilities classified as Standard Industrial Classification (SIC) major groups 30 and 39." Storm water discharges from category (xi) facilities are only regulated where precipitation and storm water runon come into contact with areas associated with industrial activities and significant materials. Sector 27 covers all storm water discharges from facilities classified as SIC 30 and 39, except for those facilities classified as SIC code 391 - Jeweler, Silverware, and Plated ware. Facilities classified as SIC code 391 are subject to Sector 29 permitting requirements.

Major SIC group 30 includes rubber and miscellaneous plastic products. Specifically, this SIC group includes manufacturers of tires and inner tubes, rubber and plastic footwear, rubber and plastic hose and belting, gaskets, packing and sealing devices, and miscellaneous fabricated rubber products. This SIC group also includes miscellaneous plastic products such as unsupported plastic film, sheet, rods and tubes, laminated plastic plate, sheet and profile shapes, plastic pipe and bottles, plastic foam products such as cups, ice chests and packaging materials, plastic plumbing fixtures, and miscellaneous plastic products.

Major SIC group 39 (except 391) includes miscellaneous manufacturing industries. Specifically, this group includes manufacturers of musical instruments, games, toys and athletic goods, pens, pencils and artists' supplies, buttons, and pins and needles.

Pollutants found in storm water discharges from rubber and miscellaneous plastic products manufacturers may include total suspended solids (TSS), oil and grease, zinc, and acids.

Table E-27
Summary Statistics From (Part 2) Sampling Results by Industrial Sector
Industrial Sector 27

Pollutant	Grab Samples (mg/l)				Composite Samples (mg/l)				NURP Results (mg/l)		
	No.	Mean	Median	95%	No.	Mean	Median	95%	Mean	Median	90%
BOD5	90	13.92	7.15	51.00	89	11.21	7.00	34.00	12.00	9.00	15.00
COD	90	100.00	53.00	330.00	87	72.08	43.00	240.00	82.00	65.00	140.00
Copper	5	0.00	0.00	0.01	5	0.03	0.05	0.05	0.04	0.04	0.09
Lead	1	0.00	0.00	0.00	1	0.01	0.01	0.01	0.18	0.14	0.35
NO_2+NO_3-N	89	0.86	0.58	2.93	86	1.26	0.67	3.56	0.86	0.68	1.75
Oil & Grease	94	4.26	0.50	18.00					NR	NR	NR
P, Total	89	0.41	0.19	1.61	85	0.34	0.16	0.83	0.42	0.33	0.70
pH	86	7.17	7.10	8.40					NR	NR	NR
TKN	89	2.34	1.36	6.00	86	1.63	1.25	4.70	1.90	1.50	3.30
TSS	90	188.55	44.00	893.00	87	119.32	30.00	476.00	180.00	100.00	300.00
Zinc	34	0.98	0.19	4.90	34	0.80	0.25	2.86	0.20	0.16	0.50

Sector 28: Leather Tanning and Finishing Facilities

The definition of storm water discharges associated with industrial activity includes point source discharges of storm water from eleven major categories of facilities, including: "...category (ii) facilities classified as Standard Industrial Classification (SIC) code 3111." Storm water discharges covered include those from leather tanning facilities and facilities which make fertilizer solely from leather scraps and leather dust where precipitation and storm water runon come into contact with significant materials including, but not limited to, raw materials, waste products, by-products, stored materials, and fuels.

Leather tanning or finishing is the conversion of animal hides or skins into leather. Leather is made from the inner layer of the animal skin, which consists primarily of the protein collagen. Tanning is the reaction of the collagen fibers with tannins, chromium, alum or other tanning agents. Tanning processes use sodium dichromate, sulfuric acid and detergents and a variety of raw and intermediate materials.

There are three major processes required to make finished leather. These are beamhouse operations, tanyard processes and retanning and finishing processes.

- Beamhouse Operations—These consist of four activities: side and trim; soak and wash; fleshing and unhairing. Side and trim is the cutting of the hide into two sides and trimming of areas which do not produce good leather. In soak and wash processes, the hides are soaked in water to restore moisture lost during curing. Washing removes dirt, salt, blood, manure, and nonfibrous proteins. Fleshing is a mechanical operation which removes excess flesh. The removed matter is normally recovered and sold for conversion to glue. Unhairing involves using calcium hydroxide, sodium sulfhydrate, and sodium sulfide to destroy the hair (hair pulp process) or remove hair roots.

- Tanyard Processes—These consist of bating, pickling, tanning, wringing, splitting, and shaving. Bating involves the addition of salts of ammonium sulfate or ammonium chloride used to convert the residual alkaline chemicals present from the unhairing process into soluble compounds which can be washed from the hides or skins. "Pickling" the hide with sulfuric acid provides the acid environment necessary for chromium tanning. In the tanning process, tanning agents such as trivalent chromium and vegetable tannins convert the hide into a stable product which resists decomposition. Wringing of the "blue hides" (hides tanned with chromium) removes excess moisture with a machine similar to a clothes wringer. Splitting adjusts the thickness of the tanned hide to the requirements of the finished product and produces a "split" from the flesh side of the hide. The hide is then shaved to remove any remaining fleshy matter.

- Retanning and Wet Finishing Processes—These include retanning, bleaching, coloring, fatliquoring, and finishing. The most common retanning agents are chromium, vegetable extracts and syntans (based upon naphthalene and phenol). Sodium

bicarbonate and sulfuric acid are sometimes used to bleach leather. Coloring involves the use of dyes (usually aniline based) on the tanned skin. Animal or vegetable fatliquors are added to replace the natural oils lost in the beamhouse and tanyard processes. Finishing includes all operations performed on the hide after fatliquoring, and includes finishing to enhance color and resistance to stains and abrasions, smoothing and stretching of the skin, drying, conditioning, staking, dry milling, buffing and plating.

Significant materials include raw materials, brine or salt cured hides and skins, fuels, materials such as solvents, detergents, finished materials, fertilizers, pesticides, waste products, leather shavings and dust, leather scrap, blue hides and splits, empty chemical containers, spent solvents, and emissions from spray booths.

Pollutants include aluminum, manganese, Total Kjeldahl Nitrogen (TKN), nitrate + nitrite as N, and Biochemical Oxygen Demand (BOD_5).

Table E-28
Summary Statistics From (Part 2) Sampling Results by Industrial Sector
Industrial Sector 28

	Grab Samples (mg/l)				Composite Samples (mg/l)				NURP Results (mg/l)		
Pollutant	No.	Mean	Median	95%	No.	Mean	Median	95%	Mean	Median	90%
BOD5	31	33.07	11.00	140.00	31	22.32	10.00	77.00	12.00	9.00	15.00
COD	31	205.45	82.00	900.00	31	91.94	50.00	340.00	82.00	65.00	140.00
Copper									0.04	0.04	0.09
Lead	2	0.02	0.02	0.04	2	0.02	0.02	0.04	0.18	0.14	0.35
NO_2+NO_3-N	31	1.86	1.20	4.70	31	1.88	0.90	9.10	0.86	0.68	1.75
Oil & Grease	31	13.87	0.00	120.00					NR	NR	NR
P, Total	31	0.36	0.16	1.60	31	0.83	0.18	1.30	0.42	0.33	0.70
pH	31	7.21	7.40	8.60					NR	NR	NR
TKN	31	7.70	4.30	22.00	31	6.22	3.50	15.00	1.90	1.50	3.30
TSS	31	309.84	49.00	1300.00	31	114.81	86.00	460.00	180.00	100.00	300.00
Zinc									0.20	0.16	0.50

Sector 29: Fabricated Metal Products Facilities

The definition of storm water discharges associated with industrial activity includes point source discharges of storm water from eleven major categories of facilities, including: "...category (xi) facilities classified as Standard Industrial Classification (SIC) codes 34 and 391." Storm water discharges from fabricated metal and processing facilities eligible for coverage include the following types of operations:

- Fabricated Metal Products, Except Machinery and Transportation Equipment, SIC code 34 (3429, 3441, 3442, 3443, 3444, 3451, 3452, 3462, 3465, 3471, 3479, 3494, 3496, 3499)

- Jewelry, Silverware, and Plated Ware, SIC code 391.

This section covers establishments engaged in fabricating ferrous and nonferrous metal products, such as metal cans, tinware, general hardware, automotive parts, tanks, road mesh, structural metal products, nonelectrical equipment, and a variety of metal and wire products made from purchased iron or steel rods, bars, or wire materials.

These facilities are engaged in the manufacturing of a variety of products that are constructed primarily by using metals. The operations performed usually begin with materials in the form of raw rods, bars, sheet, castings, forgings, and other related materials and can progress to the most sophisticated surface finishing operations. There are typically several operations that take place at a fabrication facility: machining operations, grinding, cleaning and stripping, surface treatment and plating, painting, and assembly. The machining operation involves turning, drilling, milling, reaming threading, broaching, grinding, polishing, cutting and shaping, and planing. Grinding is the process using abrasive grains such as aluminum oxide, silicon carbide, and diamond to remove stock from a workpiece. Cleaning and stripping is a preparatory process involving solvents for the removal of oil, grease and dirt. Both alkaline and acid cleaning are employed. Surface treatment and plating is a major component that involves batch operations to increase corrosion or abrasion resistance. This is generally in the form of galvanizing. Painting is generally practiced at most facilities to provide decoration and protection to the product. Assembly is the fitting together of previously manufactured parts into a complete unit or structure.

Areas with significant materials include those with waste storage, outside product storage, used for pickling acids, storage of cutoff scrap metal, aluminum scraps, hazardous materials, galvanized steel components, solvent storage, waste paper storage, and machinery storage.

Pollutants at these facilities include aluminum, copper, manganese, nitrate + nitrite as N, iron, and zinc.

Table E-29
Summary Statistics From (Part 2) Sampling Results by Industrial Sector
Industrial Sector 29

Pollutant	Grab Samples (mg/l)				Composite Samples (mg/l)				NURP Results (mg/l)		
	No.	Mean	Median	95%	No.	Mean	Median	95%	Mean	Median	90%
BOD5	115	28.31	7.60	81.00	111	10.04	7.00	40.00	12.00	9.00	15.00
COD	115	118.16	56.00	440.00	114	86.17	47.50	249.00	82.00	65.00	140.00
Copper	36	0.63	0.03	4.30	33	0.46	0.02	0.64	0.04	0.04	0.09
Lead	32	0.11	0.00	0.89	30	0.06	0.00	0.22	0.18	0.14	0.35
NO_2+NO_3-N	115	1.48	0.74	7.00	114	1.27	0.77	3.50	0.86	0.68	1.75
Oil & Grease	114	6.11	2.00	21.00					NR	NR	NR
P, Total	113	1.03	0.22	9.80	114	0.84	0.21	4.80	0.42	0.33	0.70
pH	103	7.06	7.05	8.70					NR	NR	NR
TKN	115	2.61	1.37	7.20	114	1.78	1.20	5.75	1.90	1.50	3.30
TSS	115	186.58	76.00	758.00	114	125.39	32.00	423.00	180.00	100.00	300.00
Zinc	60	4.20	0.36	9.77	58	2.17	0.21	10.50	0.20	0.16	0.50

Sector 30: Transportation Equipment, Industrial or Commercial Machinery Manufacturing Facilities

The definition of storm water discharge associated with industrial activity includes point source discharges of storm water from eleven categories of facilities, including: "...category (xi) facilities classified as Standard Industrial Classification (SIC) codes ... 34 (except 3441), 35, 37 (except 373),..." Under these SIC codes, the facilities subject to storm water regulations include:

- Fabricated Structural Metal Products, (SIC Code 344)
- Metal Forgings and Stampings, (SIC Code 346)
- Miscellaneous Fabricated Metal Products (SIC Code 349)
- Engines and Turbines (SIC Code 351)
- Farm and Garden Machinery and Equipment (SIC Code 352)
- Construction, Mining, and Materials Handling Machinery and Equipment (SIC Code 353)
- Metalworking Machinery and Equipment (SIC Code 354)
- Special Industry Machinery, Except Metalworking Machinery (SIC Code 355)
- General Industrial Machinery and Equipment (SIC Code 356)
- Refrigeration and Service Industry Machinery (SIC Code 358)
- Miscellaneous Industrial and Commercial Machinery and Equipment (SIC Code 359)
- Motor Vehicles and Motor Vehicle Equipment (SIC Code 371)
- Aircraft and Parts (SIC Code 372)
- Motorcycles, Bicycles, and Parts (SIC Code 375)
- Guided Missiles and Space Vehicles and Parts (SIC Code 376)
- Miscellaneous Transportation Equipment (SIC Code 379)

The general manufacturing process is conducted indoors, and includes activities such as cutting, shaping, grinding, cleaning, coating, forming, and finishing. Specific processes are referred to as "unit operations." These operations occur predominately indoors, so contamination of storm water discharges from manufacturing processes is unlikely.

Significant materials include ferrous and nonferrous metals, such as aluminum, copper, iron, steel and alloys of these metals; either in raw form or as intermediate products, paints, solvents (e.g., paint thinners, degreasers), chemicals (e.g., acids, bases, liquid gases), fuels (e.g., gasoline and diesel fuel), lubricating and cutting oils, and plastics.

Pollutants of concern at these facilities include total suspended solids (TSS), turbidity, fugitive dust, oil and grease, organics, heavy metals, and chemical oxygen demand (COD).

Table E-30
Summary Statistics From (Part 2) Sampling Results by Industrial Sector
Industrial Sector 30

Pollutant	Grab Samples (mg/l)				Composite Samples (mg/l)				NURP Results (mg/l)		
	No.	Mean	Median	95%	No.	Mean	Median	95%	Mean	Median	90%
BOD5	182	13.01	6.00	32.00	179	7.34	5.00	19.00	12.00	9.00	15.00
COD	174	66.89	36.00	310.00	169	46.55	29.00	149.20	82.00	65.00	140.00
Copper	79	0.20	0.01	0.84	74	0.06	0.01	0.36	0.04	0.04	0.09
Lead	76	0.22	0.00	0.97	75	0.18	0.00	0.94	0.18	0.14	0.35
NO_2+NO_3-N	184	1.20	0.58	5.00	174	1.28	0.45	4.50	0.86	0.68	1.75
Oil & Grease	189	7.84	0.00	34.00					NR	NR	NR
P, Total	176	0.29	0.14	1.00	179	0.40	0.13	1.12	0.42	0.33	0.70
pH	179	6.93	7.09	8.34					NR	NR	NR
TKN	170	2.47	1.30	5.80	165	1.81	1.10	4.75	1.90	1.50	3.30
TSS	173	162.81	30.00	576.00	169	100.41	17.00	319.00	180.00	100.00	300.00
Zinc	88	0.58	0.20	2.55	85	0.39	0.14	1.40	0.20	0.16	0.50

Sector 31: Electronic and Electrical Equipment and Components, Photographic and Optical Goods

The definition of storm water discharges associated with industrial activity includes point source discharges of storm water from eleven major categories of facilities, including: "... category (xi) facilities classified as Standard Industrial Classification (SIC) codes 36, 38, and 357."

Major SIC group 36 includes manufacturers of a broad range of electronic and electrical equipment and components, not including computer equipment. Specifically, this group includes manufacturers of electricity distribution equipment such as transformers and switch-gear, electrical industrial equipment such as motors and generators, household appliances, electric lighting and wiring equipment such as light bulbs and lighting fixtures, and audio and video equipment including phonograph records and audio tapes and disks. Also included are manufacturers of communication equipment including telephone and telegraph equipment, radio and television equipment, electronic components such as printed circuit boards and semiconductors and related devices, and miscellaneous electrical items such as batteries and electrical equipment for automobiles. Storm water discharges from facilities in this category are only regulated where precipitation and storm water runon come into contact with areas associated with industrial activities and significant materials.

Major SIC group 38 includes manufacturers of measuring, analyzing, and controlling instruments, photographic, medical and optical goods, and watches and clocks. Specifically, this group includes facilities which manufacture search, detection, navigation, or guidance systems such as radar and sonar equipment, measurement and control instruments and laboratory apparatus, surgical, medical and dental instruments and supplies, photographic equipment and supplies, and watches and clocks.

Computer and office equipment is included in industrial SIC group 357. This group includes manufacturers of computers, computer storage devices, and peripheral equipment for computers such as printers and plotters. Manufacturers of miscellaneous office machines are also included in this group.

Pollutants found in storm water discharges from Electronic and Electrical Equipment and Components, Photographic and Optical Goods manufacturers may include total suspended solids (TSS), heavy metals, organics, oil and grease, and acids.

Table E-31
Summary Statistics From (Part 2) Sampling Results by Industrial Sector
Industrial Sector 31

Pollutant	Grab Samples (mg/l)				Composite Samples (mg/l)				NURP Results (mg/l)		
	No.	Mean	Median	95%	No.	Mean	Median	95%	Mean	Median	90%
BOD5	64	8.81	5.50	32.00	56	7.48	5.10	14.00	12.00	9.00	15.00
COD	65	59.19	46.00	170.00	56	36.32	24.00	200.00	82.00	65.00	140.00
Copper	54	0.04	0.00	0.11	50	0.01	0.00	0.05	0.04	0.04	0.09
Lead	60	0.02	0.00	0.08	56	0.01	0.00	0.04	0.18	0.14	0.35
NO_2+NO_3-N	64	0.83	0.51	2.80	57	0.66	0.51	1.43	0.86	0.68	1.75
Oil & Grease	69	0.58	0.00	4.10					NR	NR	NR
P, Total	64	1.50	0.13	1.10	57	1.02	0.16	1.20	0.42	0.33	0.70
pH	69	7.43	7.54	8.60					NR	NR	NR
TKN	62	1.46	1.05	4.09	56	1.36	1.01	3.70	1.90	1.50	3.30
TSS	63	89.21	29.00	348.00	56	67.12	14.00	370.00	180.00	100.00	300.00
Zinc	51	0.16	0.09	0.53	48	0.15	0.09	0.47	0.20	0.16	0.50

APPENDIX F

GROUP APPLICATION PART 2 SAMPLING DATA

ORGANIZED BY POLLUTANT

APPENDIX F

GROUP APPLICATION PART 2 SAMPLING DATA

ORGANIZED BY POLLUTANT

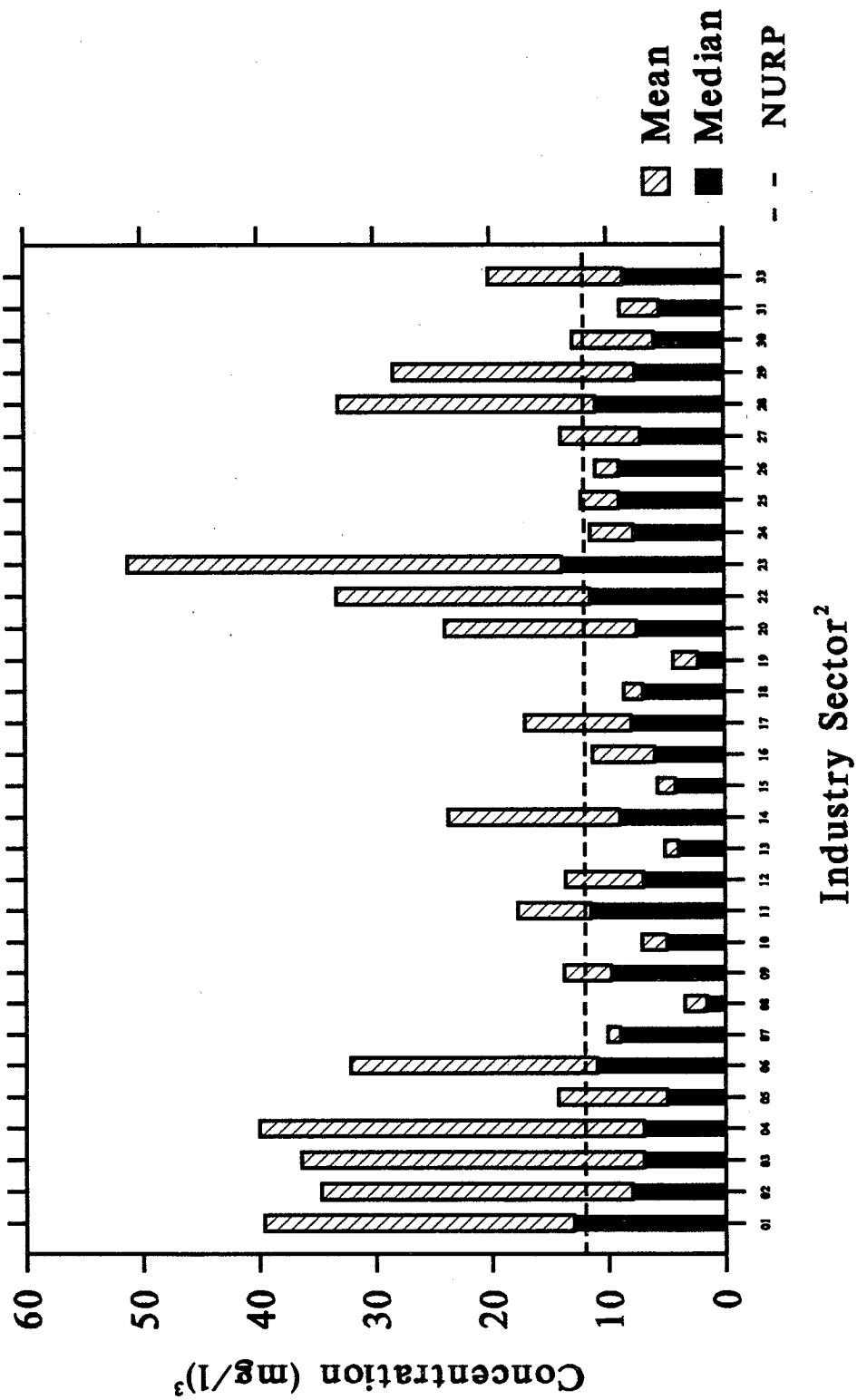
This appendix contains tabular and graphical descriptions of the sampling data for the 31 industrial sectors that were identified in the group application portion of the Phase I permitting process (four of the sectors were consolidated into two sectors for permit development purposes, only tablular data is presented for copper, lead, and zinc). This appendix summarizes the sampling data on a pollutant by pollutant basis. The tables and figures display the mean values, median values, 95th percentile values, for the grab and composite samples and the mean, median and 90th percentile values for NURP data for a portion of the pollutants sampled within each sector.

INDUSTRIAL SECTORS/GROUP APPLICATIONS (TABLE 1)	
SECTOR	ACTIVITIES REPRESENTED
1	Lumber and Wood Products
2	Paper and Allied Products
3	Chemicals and Allied Products
4	Asphalt and Lubricant Manufacturers
5	Stone, Clay, Glass and Concrete Products
6	Primary Metal Industries
7	Metal Mining
8	Coal and Lignite Mining
9	Oil and Gas Extraction
10	Mining and Quarrying of Nonmetallic Minerals
11	Hazardous Waste Treatment Storage or Disposal Facilities
12	Industrial Landfills, Land Application Sites and Open Dumps
13	Used Motor Vehicle Parts
14	Scrap and Waste Materials
15	Steam Electric Power Generating Facilities
16	Railroad Transportation
17	Local and Suburban Transit and Interurban Highway Passenger Transportation Motor Freight Transportation United States Postal Service Petroleum Bulk Stations
18	Water Transportation
19	Ship Building and Repairing Boat Building and Repairing
20	Transportation By Air
22	Domestic Wastewater Treatment Plants
23	Food and Kindred Products Tobacco Products
24	Textile Mill Products Apparel and Other Finished Products Made From Fabrics and Similar Materials
25	Furniture and Fixtures Manufacturing
26	Printing Publishing and Allied Industries
27	Rubber and Misc. Plastic Products
28	Leather and Leather Products
29	Fabricated Metal Products, Except Machinery and Transportation Equipment Jewelry, Silverware, and Plated Ware
30	Industrial and Commercial Machinery (Except Computer and Office Equipment) Transportation Equipment
31	Electronic and other Electrical Equipment and Components Measuring, Analyzing, and Controlling Instruments; Photographic and Optical Goods; Watches and Clocks

Table F-1
Summary of Sampling Data From Phase I Part II Permit Applications (With Comparison to NURP and USGS Data) for BOD_5 (mg/l)

Sector	DESCRIPTION	Grab Samples				Composite Samples			
		No.	Mean	Median	95 %	No.	Mean	Median	95 %
	FOR POLLUTANT	BOD5				BOD5			
NURP	Median Urban Site *						12	9	15
USGS	Commercial Site *						16	8	NR
01	Lumber & Wood Products	198	39.63	13.00	193.00	200	45.37	17.00	135.50
02	Paper & Allied Products	121	34.72	8.00	115.00	111	24.25	8.00	93.00
03	Chemicals & Allied Products	165	36.42	7.00	67.00	156	11.74	6.00	45.00
04	Petrol Refining & Related Ind.	61	39.99	7.00	47.00	51	10.87	4.00	22.00
05	Stone, Clay, Glass Products	310	14.30	5.00	32.00	300	7.32	4.20	26.00
06	Primary Metal Ind.	163	32.15	11.00	83.00	140	34.08	8.30	61.50
07	Metal Mining	18	10.02	9.00	27.00	12	10.63	6.00	44.00
08	Coal & Lignite Mining	7	3.63	1.80	9.00	4	6.55	3.90	17.40
09	Oil & Gas Extraction	35	13.79	9.71	44.00	33	10.59	7.00	21.80
10	Nonmetallic Mineral Mining	55	7.09	5.00	24.00	51	6.89	5.00	17.00
11	Hazardous Waste TSDFs	8	17.75	11.50	45.00	9	9.44	7.00	45.00
12	Industrial Landfills & Dumps	51	13.66	7.00	59.00	48	9.04	4.40	34.00
13	Used Motor Vehicle Parts	13	7.15	6.00	16.00	30	12.61	6.50	48.00
14	Scrap & Waste Materials	130	23.49	9.00	89.00	120	24.00	9.00	88.00
15	Steam Electric Power Plants	76	5.71	4.25	20.00	78	5.69	4.00	20.00
16	Railroad Transport	116	11.29	6.00	34.00	105	9.27	6.00	28.00
17	Transport: Trucks, Freight, etc.	400	17.11	8.00	60.50	376	11.07	6.00	41.00
18	Water Transport	15	8.60	7.00	39.00	14	6.00	6.00	11.00
19	Ship & Boat Building, Repair	44	5.00	2.80	15.00	37	7.40	0.90	23.00
20	Air Transport	96	23.95	7.50	42.00	89	21.34	5.30	41.40
22	Wastewater Treatment	90	33.26	11.50	53.40	89	46.11	8.00	200.00
23	Food, Tobacco Manufact.	298	51.15	13.90	206.00	287	42.54	11.00	180.00
24	Textile & Apparel Manufact.	110	11.41	7.75	38.00	107	9.82	7.00	29.00
25	Furniture & Fixtures	25	12.22	9.00	44.00	24	8.80	5.95	26.00
26	Printing & Publishing	27	10.99	9.00	49.00	27	6.95	6.40	22.20
27	Rubber & Plastic Products	90	13.92	7.15	51.00	89	11.21	7.00	34.00
28	Leather/Products	31	33.07	11.00	140.00	31	22.32	10.00	77.00
29	Fabricated Metal Products, Jewelry	115	28.31	7.60	81.00	111	10.04	7.00	40.00
30	Ind. & Comm. & Transport Equip.	182	13.01	6.00	32.00	179	7.32	5.00	19.00
31	Electronic Equip. & Instruments	64	8.81	5.50	32.00	56	7.48	5.10	14.00

*NURP and USGS results were reported only as composite samples, not grab.
NR = Not Reported

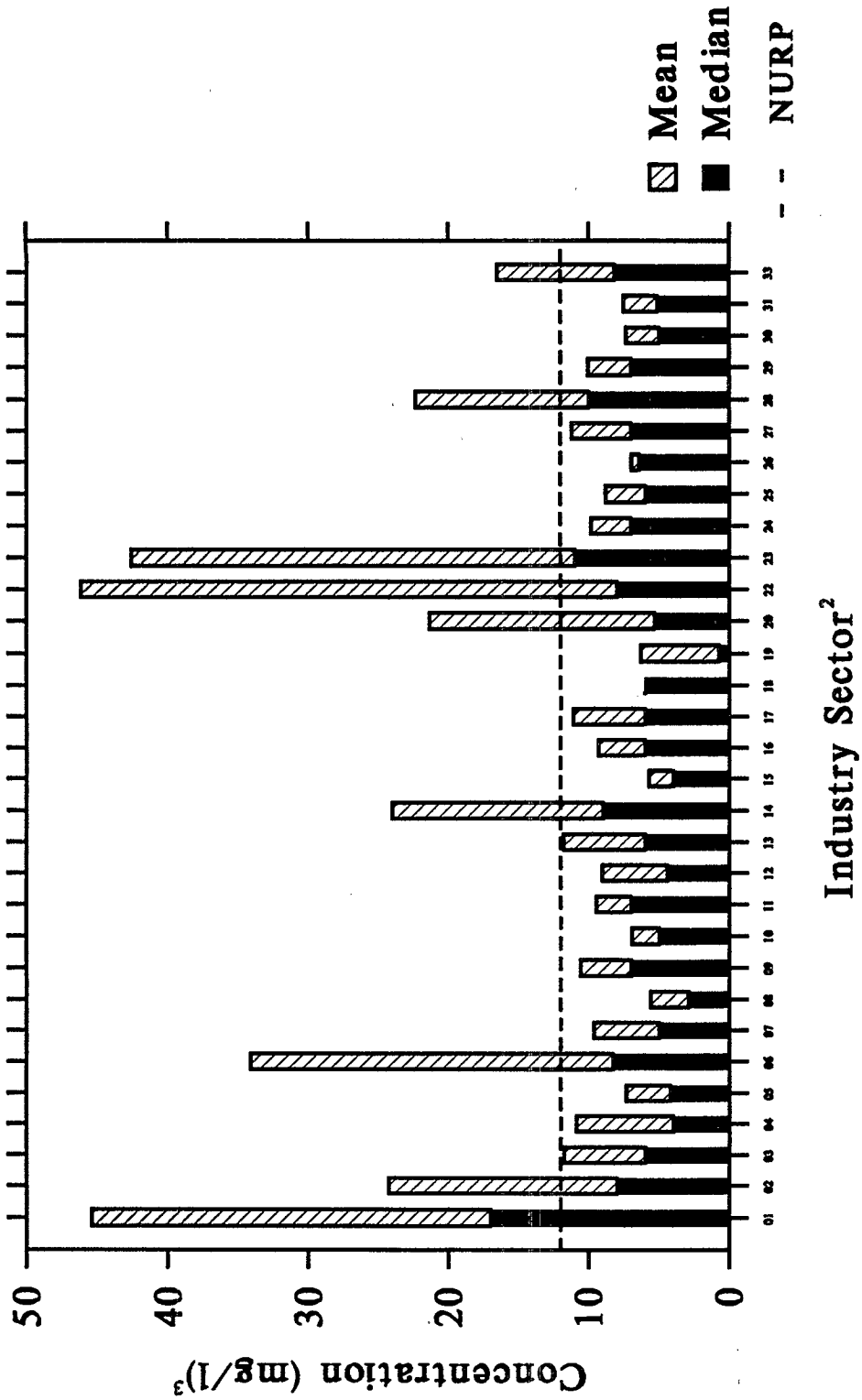


1. Based upon part 2 group application data submitted by Jan 1, 1992

2. See Table 1 for List of Industry Sectors by number

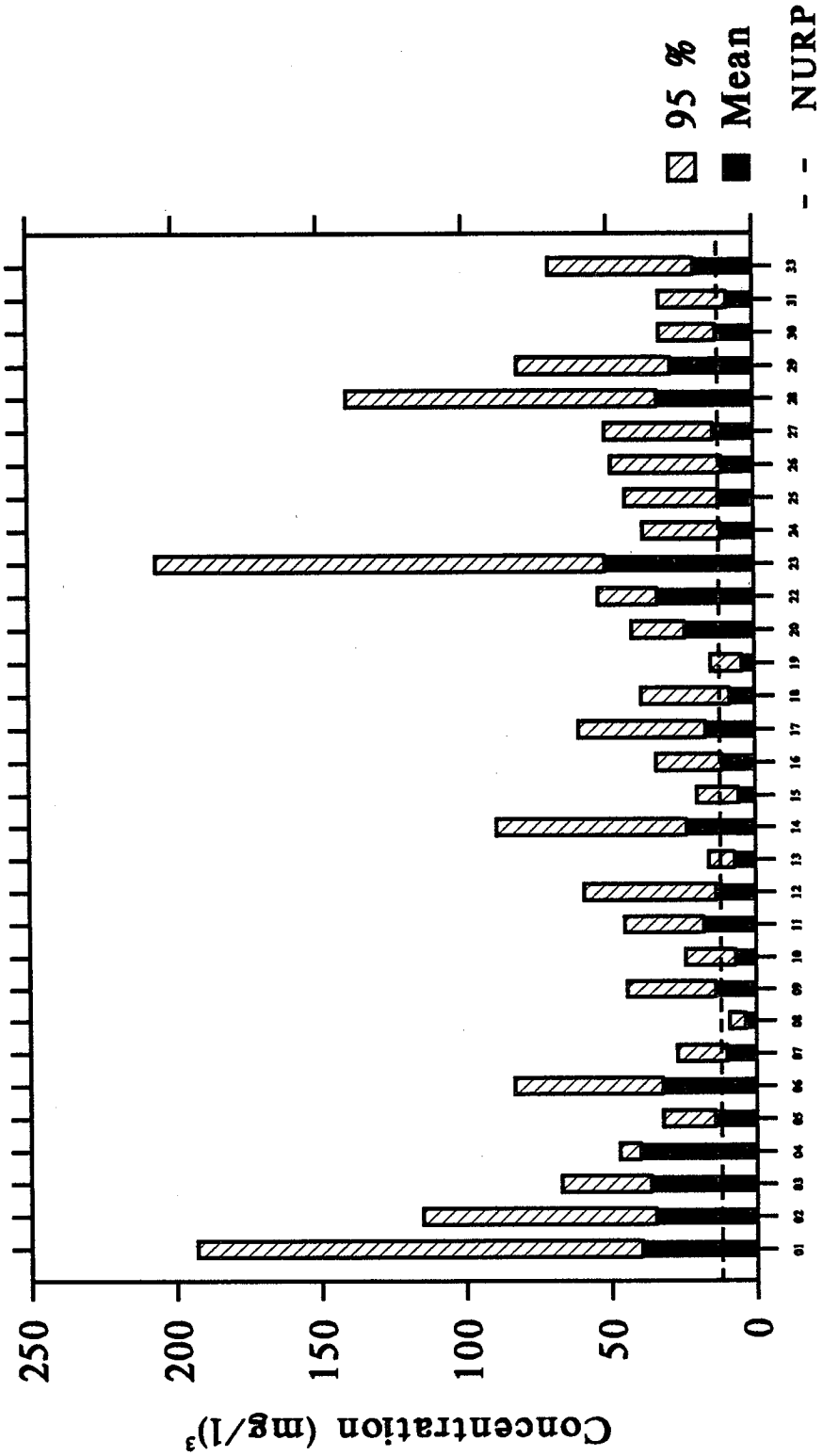
3. Values reported as Nondetect were assumed to be 0.0 mg/l

Figure F-1. BOD_5 Concentration Storm Water Discharges[1]
Grab Samples by Industry Sector



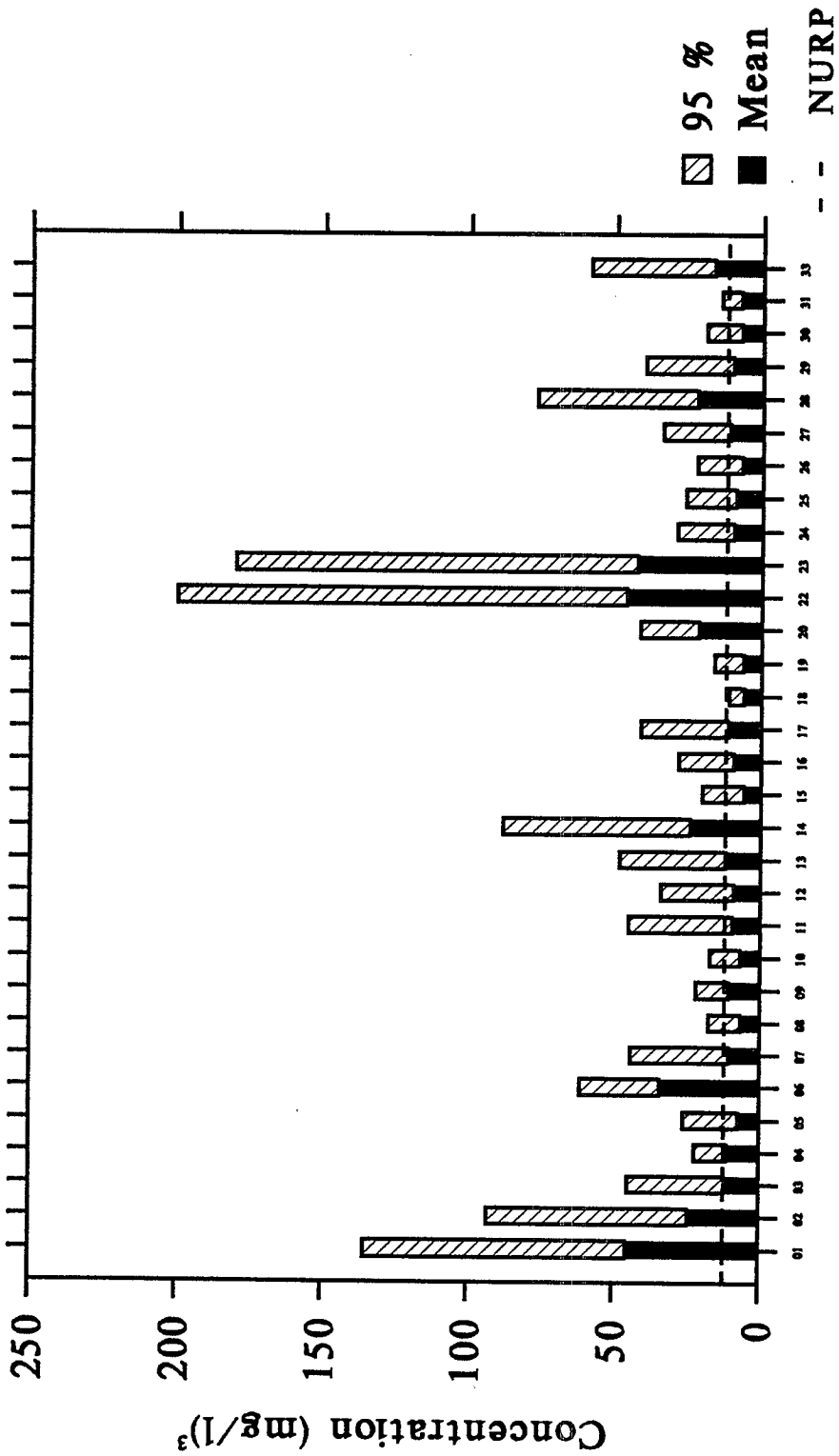
1. Based upon part 2 group application data submitted by Jan 1. 1992
2. See Table 1 for List of Industry Sectors by number
3. Values reported as Nondetect were assumed to be 0.0 mg/l

Figure F-2. BOD_5 Concentration Storm Water Discharges[1] Composite Samples by Industry Sector



1. Based upon part 2 group application data submitted by Jan 1, 1992
2. See Table 1 for List of Industry Sectors by number
3. Values reported as Nondetect were assumed to be 0.0 mg/l

Figure F-3. BOD_5 Concentration Storm Water Discharges[1]
Grab Samples by Industry Sector



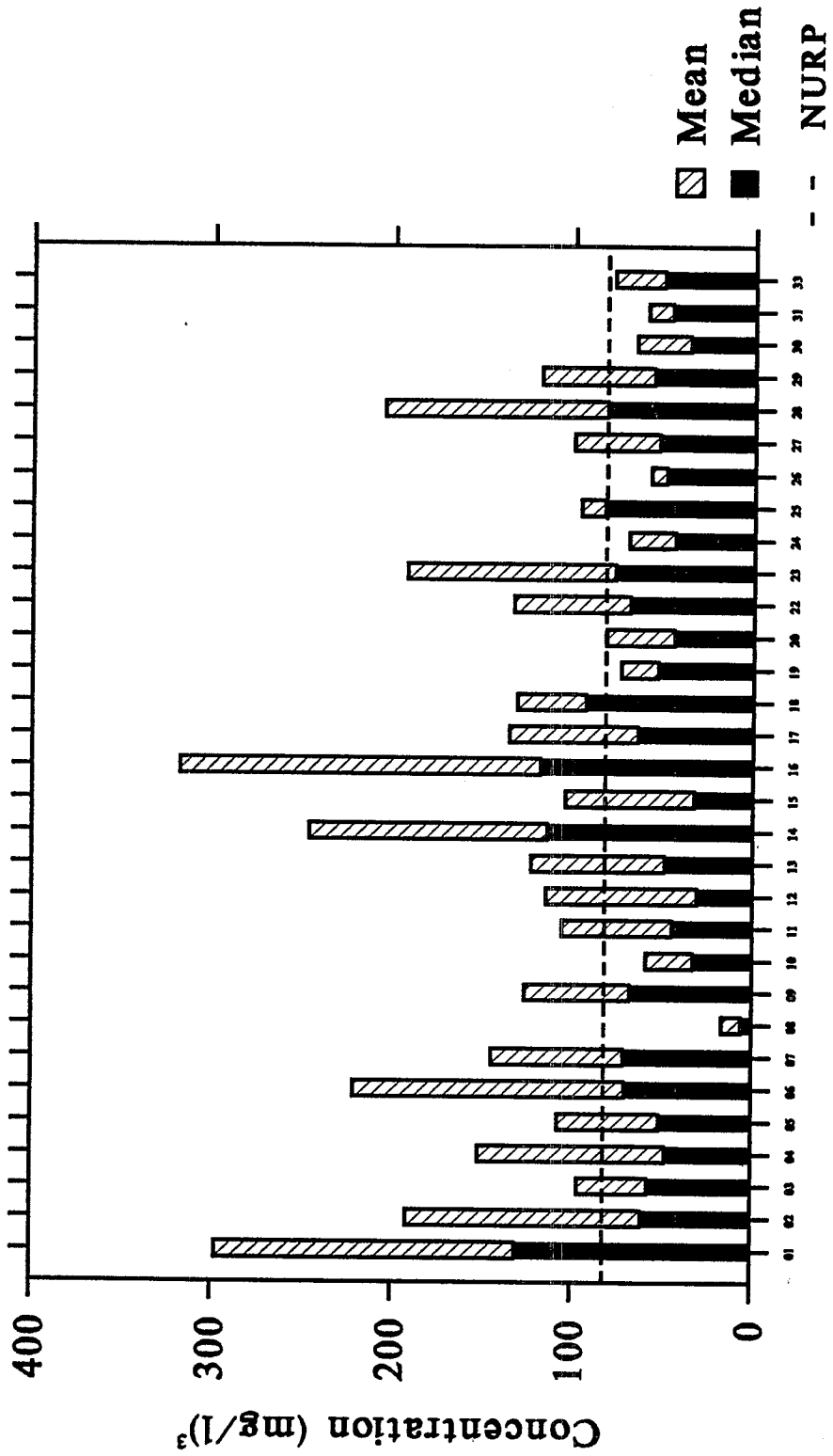
1. Based upon part 2 group application data submitted by Jan 1, 1992
2. See Table 1 for List of Industry Sectors by number
3. Values reported as Nondetect were assumed to be 0.0 mg/l

Figure F-4. BOD_5 Concentration Storm Water Discharges[1]
Composite Samples by Industry Sector

Table F-2
Summary of Sampling Data From Phase I Part II Permit Applications (With Comparison to NURP and USGS Studies) for COD (mg/l)

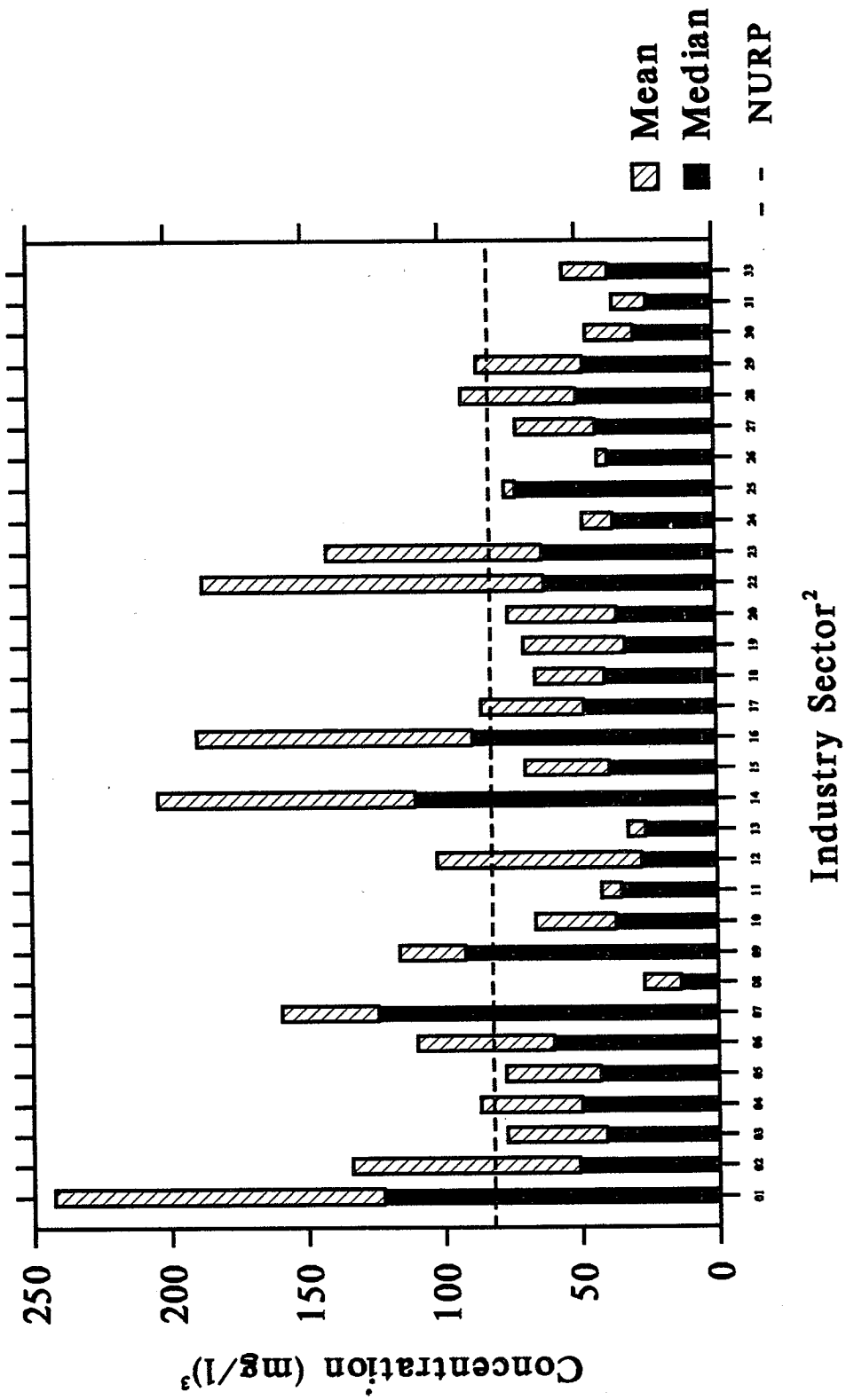
		Grab Samples				Composite Samples			
Sector	DESCRIPTION	No.	Mean	Median	95 %	No.	Mean	Median	95 %
	FOR POLLUTANT	COD				COD			
NURP	Median Urban Site *						82	65	140
USGS	Commercial Site *						NR	NR	NR
01	Lumber & Wood Products	198	297.64	131.00	1500.00	198	242.50	122.50	1080.00
02	Paper & Allied Prod.	121	191.69	61.00	740.00	113	133.90	51.00	530.00
03	Chemicals & Allied Products	168	96.14	57.50	290.00	159	77.24	41.00	320.00
04	Petrol Refining & Related Ind.	64	151.55	48.00	485.00	53	86.93	50.00	375.00
05	Stone, Clay, Glass Products	313	107.47	51.30	317.00	302	77.53	43.15	240.00
06	Primary Metal Ind.	162	221.34	70.50	870.00	151	109.84	60.00	420.00
07	Metal Mining	18	144.54	71.10	630.00	15	195.07	160.00	740.00
08	Coal & Lignite Mining	13	16.45	6.00	83.90	8	26.86	13.50	115.00
09	Oil & Gas Extraction	36	140.12	82.00	352.00	31	115.94	92.00	445.00
10	Nonmetallic Mineral Mining	56	58.79	33.00	247.00	51	66.20	37.00	185.00
11	Hazardous Waste TSDFs	8	117.40	41.00	500.00	9	48.90	34.00	131.00
12	Industrial Landfills & Dumps	51	114.46	31.00	825.00	48	102.02	27.50	548.00
13	Used Motor Vehicle Parts	30	135.00	61.00	250.00	13	66.23	60.00	155.00
14	Scrap & Waste Materials	130	253.33	120.00	1100.00	117	203.71	110.00	700.00
15	Steam Electric Power Plants	76	104.02	32.50	360.00	77	69.47	39.50	280.00
16	Railroad Transport	117	318.10	118.00	781.00	102	189.46	89.00	489.00
17	Transport: Trucks, Freight, etc.	408	135.16	63.95	498.00	374	85.64	48.00	250.00
18	Water Transport	15	130.93	93.00	500.00	14	75.79	50.50	203.00
19	Ship & Boat Building, Repair	51	73.22	53.00	260.00	43	68.80	28.00	240.00
20	Air Transport	95	81.49	44.00	286.00	88	75.63	36.00	182.00
22	Wastewater Treatment	84	133.03	68.65	410.00	84	157.95	61.59	880.00
23	Food, Tobacco Manufact.	296	192.46	77.00	745.00	286	141.65	63.00	463.00
24	Textile & Apparel Manufact.	110	69.19	44.00	228.00	107	48.05	37.00	111.00
25	Furniture & Fixtures	25	95.96	83.00	230.00	24	76.33	72.50	180.00
26	Printing & Publishing	27	57.19	49.00	176.00	27	42.37	39.00	119.00
27	Rubber & Plastic Products	90	100.00	53.00	330.00	87	72.08	43.00	240.00
28	Leather/Products	31	205.45	82.00	900.00	31	91.94	50.00	340.00
29	Fabricated Metal Products, Jewelry	115	118.16	56.00	440.00	114	86.17	47.50	249.00
30	Ind. & Comm. & Transport Equip.	174	66.89	36.00	310.00	169	46.55	29.00	149.20
31	Electronic Equip. & Instruments	65	59.19	46.00	170.00	56	36.32	24.00	200.00

*NURP and USGS results were reported only as composite samples, not grab.
NR = Not Reported



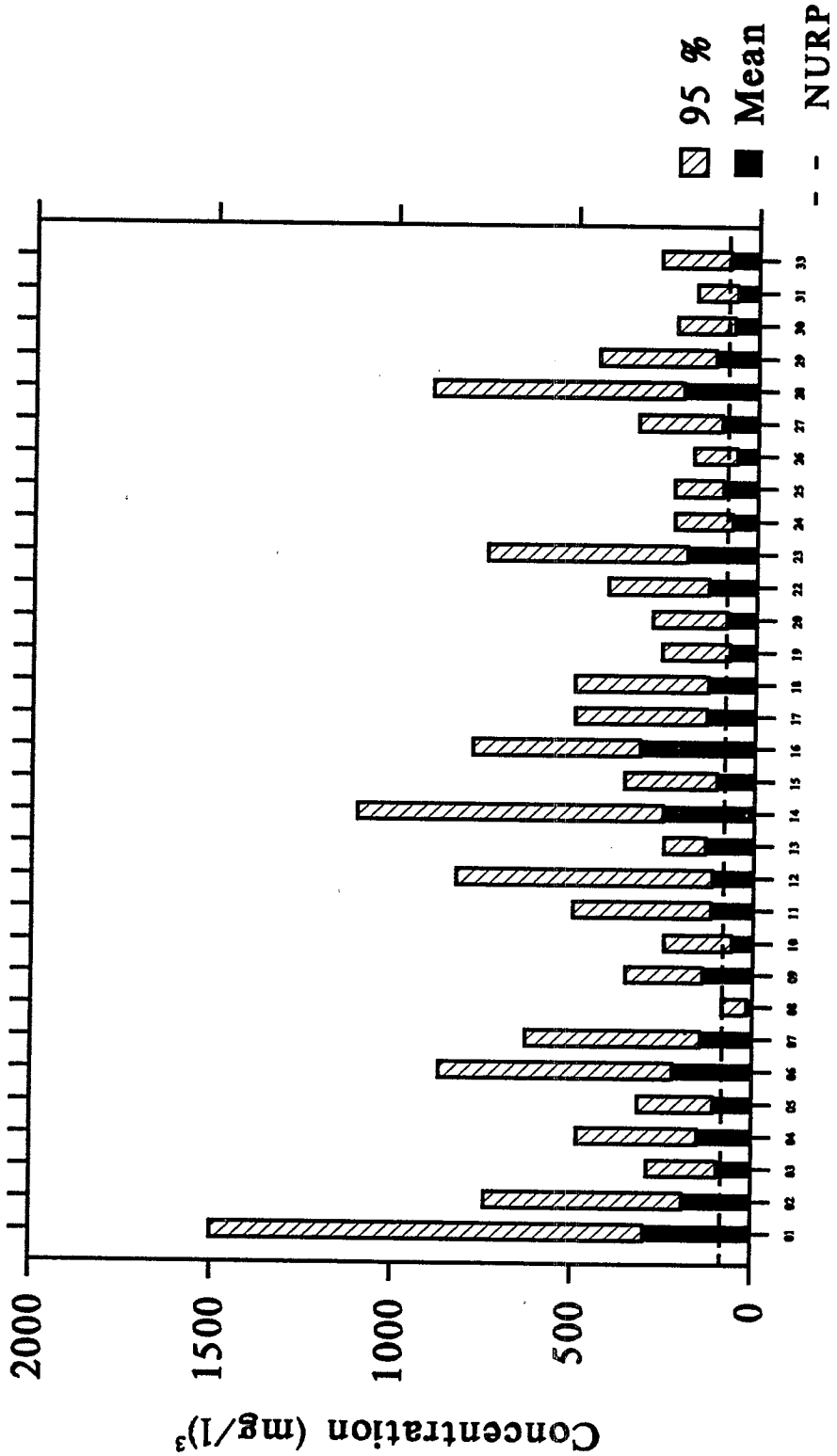
1. Based upon part 2 group application data submitted by Jan 1, 1992
2. See Table 1 for List of Industry Sectors by number
3. Values reported as Nondetect were assumed to be 0.0 mg/l

Figure F-5. COD Concentration Storm Water Discharges[1] Grab Samples by Industry Sector



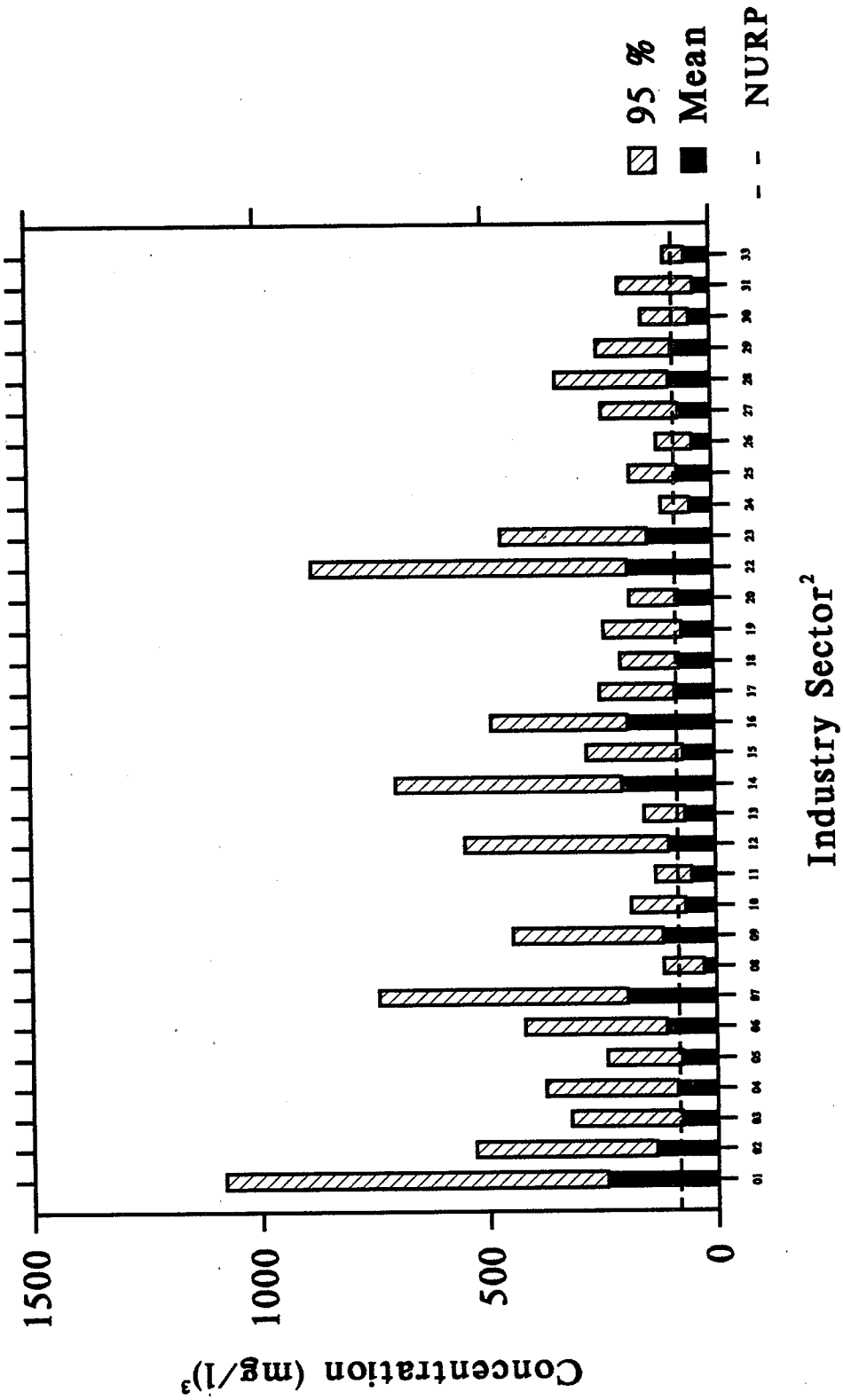
1. Based upon part 2 group application data submitted by Jan 1. 1992
2. See Table 1 for List of Industry Sectors by number
3. Values reported as Nondetect were assumed to be 0.0 mg/l

Figure F-6. COD Concentration Storm Water Discharges[1]
Composite Samples by Industry Sector



1. Based upon part 2 group application data submitted by Jan 1, 1992
2. See Table 1 for List of Industry Sectors by number
3. Values reported as Nondetect were assumed to be 0.0 mg/l

Figure F-7. COD Concentration Storm Water Discharges[1] Grab Samples by Industry Sector



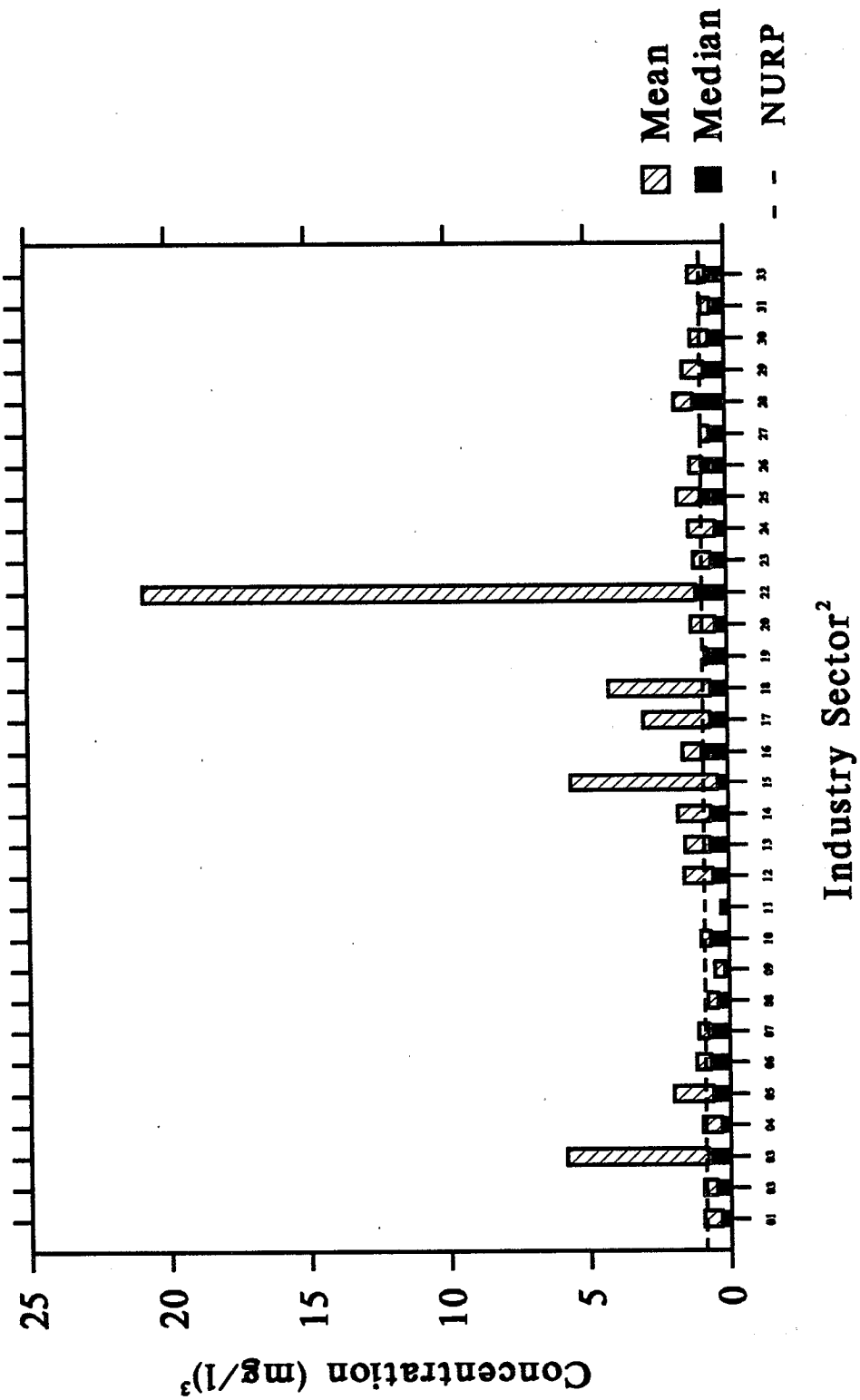
1. Based upon part 2 group application data submitted by Jan 1, 1992
2. See Table 1 for List of Industry Sectors by number
3. Values reported as Nondetect were assumed to be 0.0 mg/l

Figure F-8. COD Concentration Storm Water Discharges[1] Composite Samples by Industry Sector

Table F-3
Summary of Sampling Data From Phase I Part II Permit Applications (With Comparison to NURP and USGS Data) for NO_2 + NO^3 - N (mg/l)

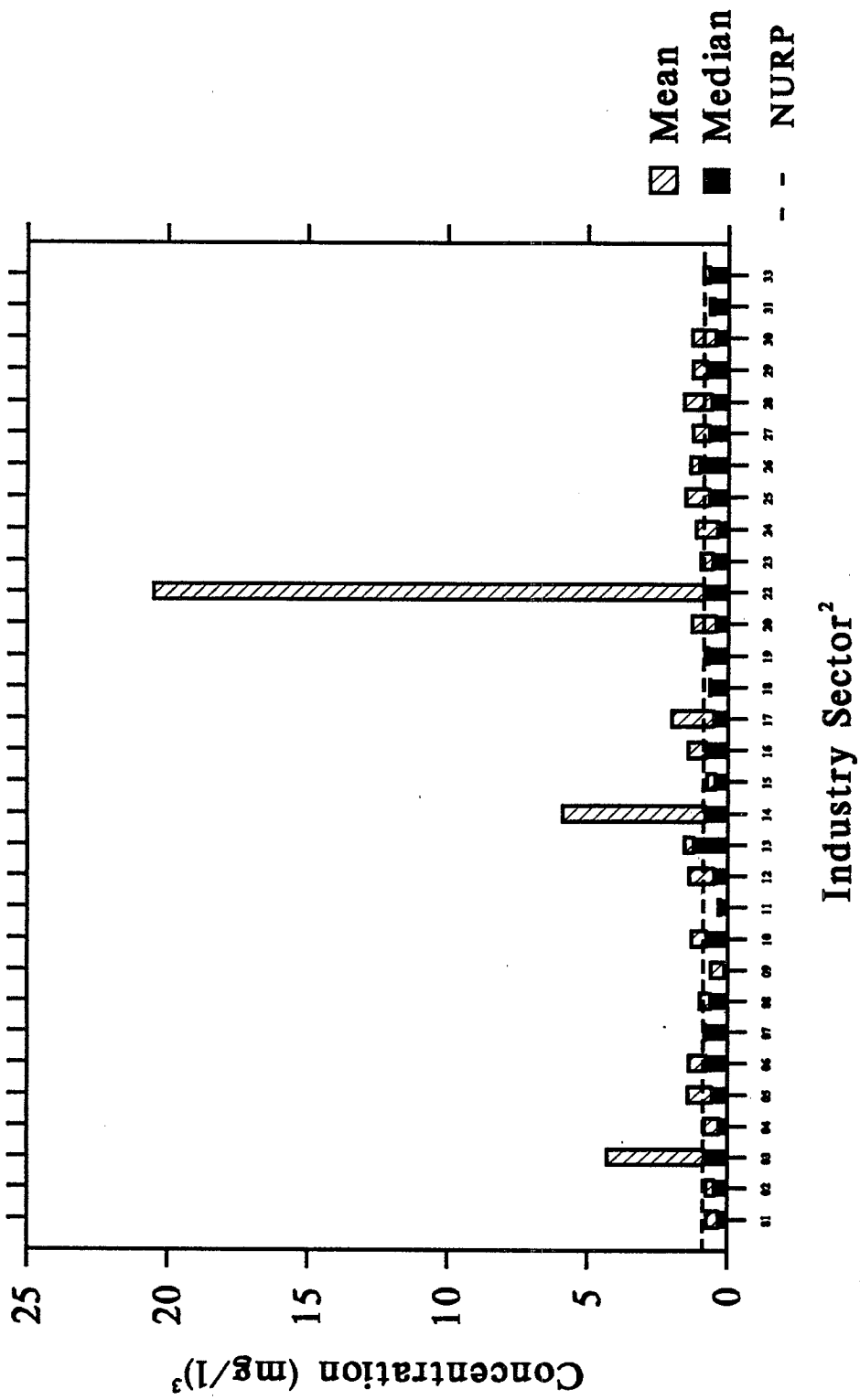
Sector	DESCRIPTION	Grab Samples				Composite Samples			
		No.	Mean	Median	95 %	No.	Mean	Median	95 %
	FOR POLLUTANT	NO_2+NO_3−N				NO_2+NO_3−N			
NURP	Median Urban Site *						0.86	0.68	1.75
USGS	Commercial Site *						0.38	0.25	NR
01	Lumber & Wood Products	189	0.95	0.32	2.20	188	0.75	0.34	1.79
02	Paper & Allied Prod.	121	0.95	0.50	3.93	111	0.76	0.47	2.44
03	Chemicals & Allied Products	164	5.83	0.80	16.00	154	4.29	0.82	17.00
04	Petrol Refining & Related Ind.	62	0.97	0.31	2.63	52	0.82	0.30	2.43
05	Stone, Clay, Glass Products	303	1.99	0.60	3.03	292	1.40	0.55	3.03
06	Primary Metal Ind.	148	1.17	0.68	3.60	135	1.38	0.77	4.30
07	Metal Mining	16	1.10	0.75	5.30	13	0.90	0.86	2.10
08	Coal & Lignite Mining	8	0.77	0.40	3.12	6	1.00	0.61	3.12
09	Oil & Gas Extraction	35	0.52	0.15	4.10	31	0.60	0.12	3.30
10	Nonmetallic Mineral Mining	50	0.98	0.65	3.00	45	1.27	0.76	4.17
11	Hazardous Waste TSDFs	9	0.46	0.47	0.79	9	0.39	0.34	0.67
12	Industrial Landfills & Dumps	50	1.57	0.55	4.10	47	1.38	0.50	6.02
13	Used Motor Vehicle Parts	13	1.70	0.83	5.65	30	1.62	1.32	4.87
14	Scrap & Waste Materials	129	1.78	0.62	3.30	117	5.88	0.80	12.00
15	Steam Electric Power Plants	76	5.62	0.36	3.70	77	0.75	0.45	3.20
16	Railroad Transport	118	1.59	0.92	6.07	102	1.41	0.78	4.26
17	Transport: Trucks, Freight, etc.	399	2.99	0.61	9.00	372	1.99	0.52	5.10
18	Water Transport	15	4.23	0.60	54.00	14	0.66	0.65	1.61
19	Ship & Boat Building, Repair	51	0.79	0.72	1.60	45	0.85	0.72	1.80
20	Air Transport	75	1.27	0.41	7.90	65	1.29	0.43	7.70
22	Wastewater Treatment	84	20.86	1.09	136.00	83	20.50	0.87	131.27
23	Food, Tobacco Manufact.	301	1.17	0.56	3.70	289	0.98	0.55	3.60
24	Textile & Apparel Manufact.	110	1.33	0.39	2.50	107	1.14	0.39	1.87
25	Furniture & Fixtures	25	1.73	0.90	6.20	24	1.51	0.68	5.60
26	Printing & Publishing	20	1.27	0.82	4.00	20	1.35	1.05	4.49
27	Rubber & Plastic Products	89	0.86	0.58	2.93	86	1.26	0.67	3.56
28	Leather/Products	31	1.86	1.20	4.70	31	1.88	0.90	9.10
29	Fabricated Metal Products, Jewelry	115	1.48	0.74	7.00	114	1.27	0.77	3.50
30	Ind. & Comm. & Transport Equip.	184	1.20	0.58	5.00	174	1.28	0.45	4.50
31	Electronic Equip. & Instruments	64	0.83	0.51	2.80	57	0.66	0.51	1.43

*NURP and USGS results were reported only as composite samples, not grab.
NR = Not Reported



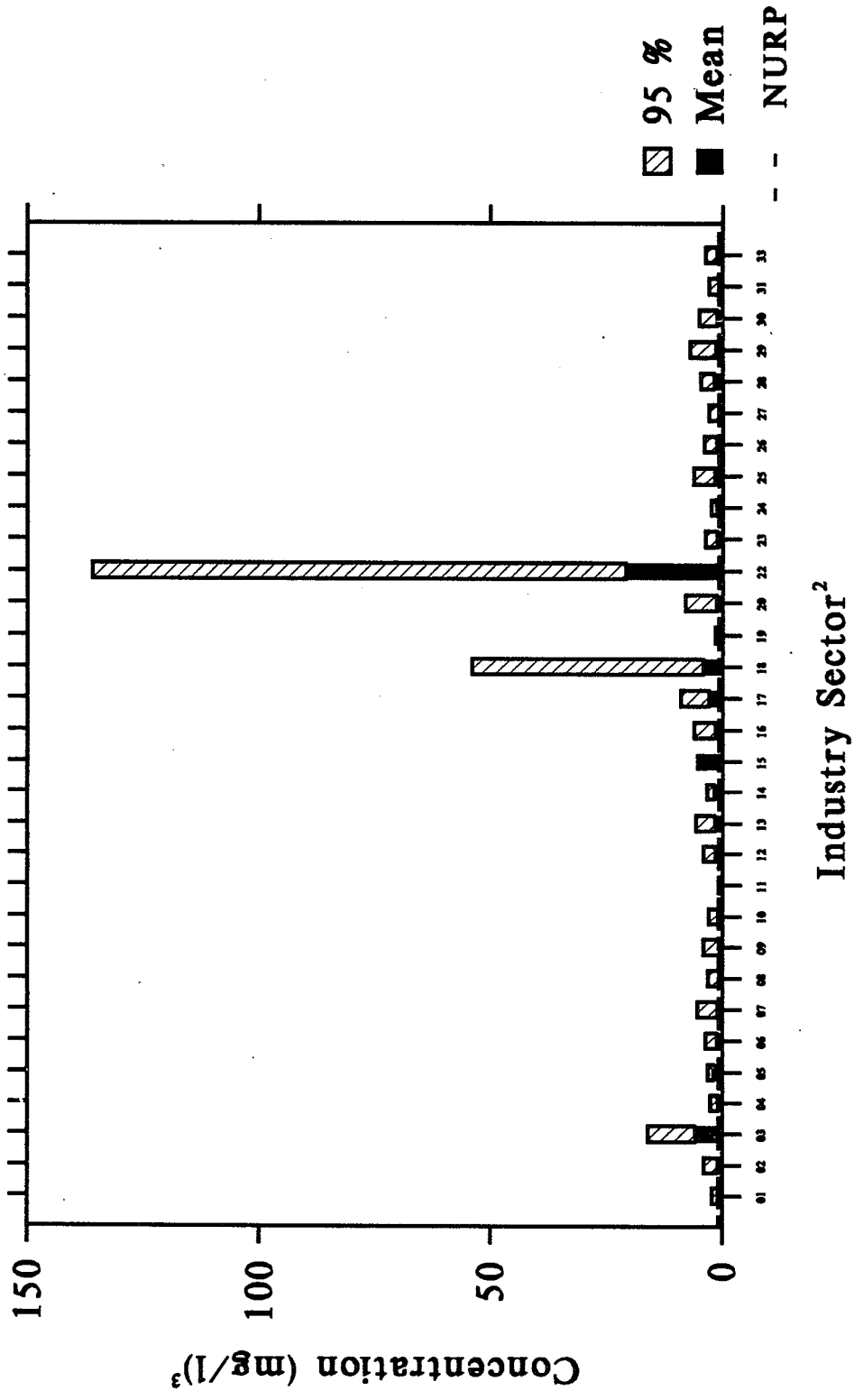
1. Based upon part 2 group application data submitted by Jan 1, 1992
2. See Table 1 for List of Industry Sectors by number
3. Values reported as Nondetect were assumed to be 0.0 mg/l

Figure F-9. Nitrate Plus Nitrite Nitrogen Concentration Storm Water Discharges[1] Grab Samples by Industry Sector



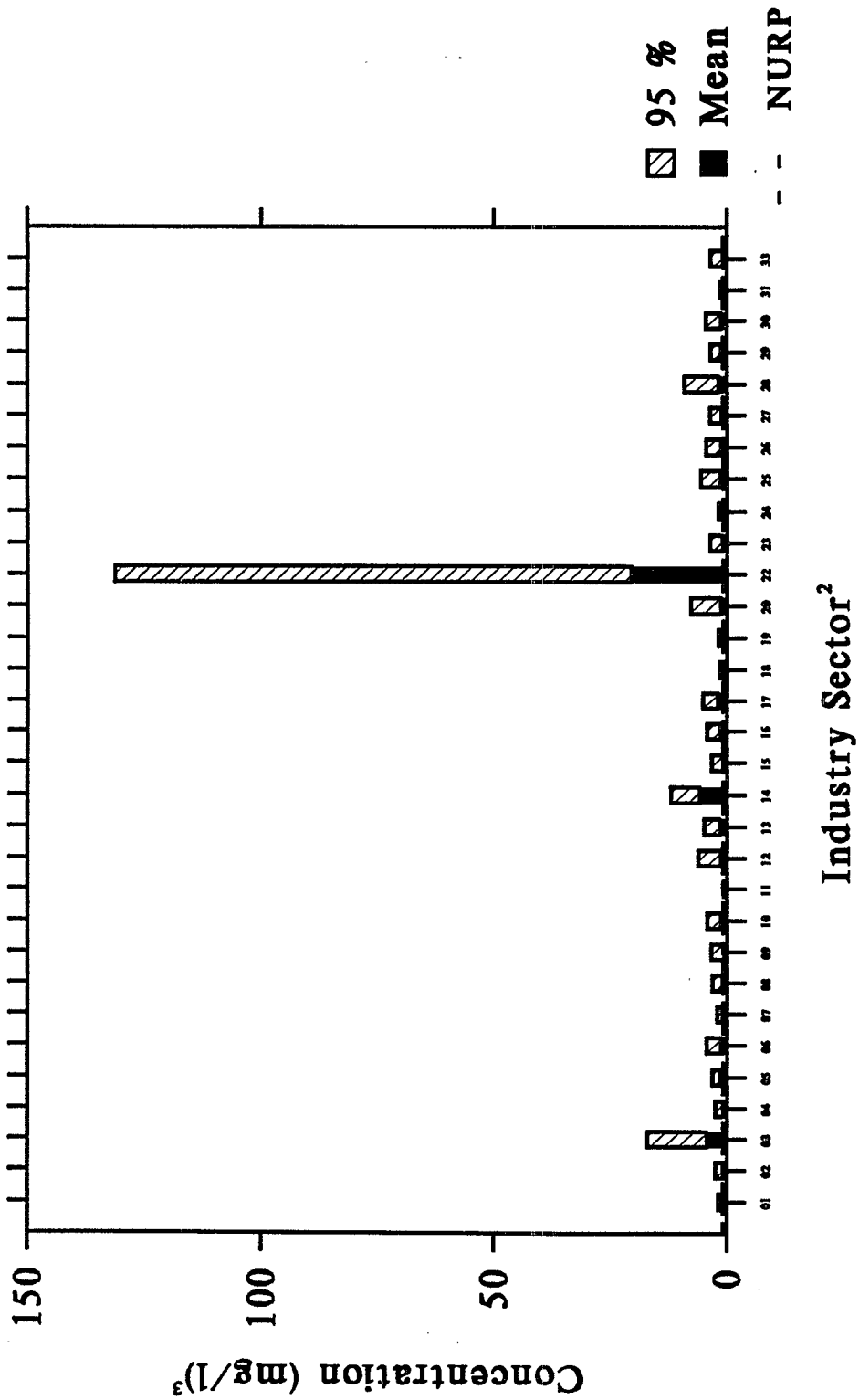
1. Based upon part 2 group application data submitted by Jan 1. 1992
2. See Table 1 for List of Industry Sectors by number
3. Values reported as Nondetect were assumed to be 0.0 mg/l

Figure F-10. Nitrate Plus Nitrite Nitrogen Concentration Storm Water Discharges[1] Composite Samples by Industry Sector



1. Based upon part 2 group application data submitted by Jan 1, 1992
2. See Table 1 for List of Industry Sectors by number
3. Values reported as Nondetect were assumed to be 0.0 mg/l

Figure F-11. Nitrate Plus Nitrite Nitrogen Concentration Storm Water Discharges[1] Grab Samples by Industry Sector



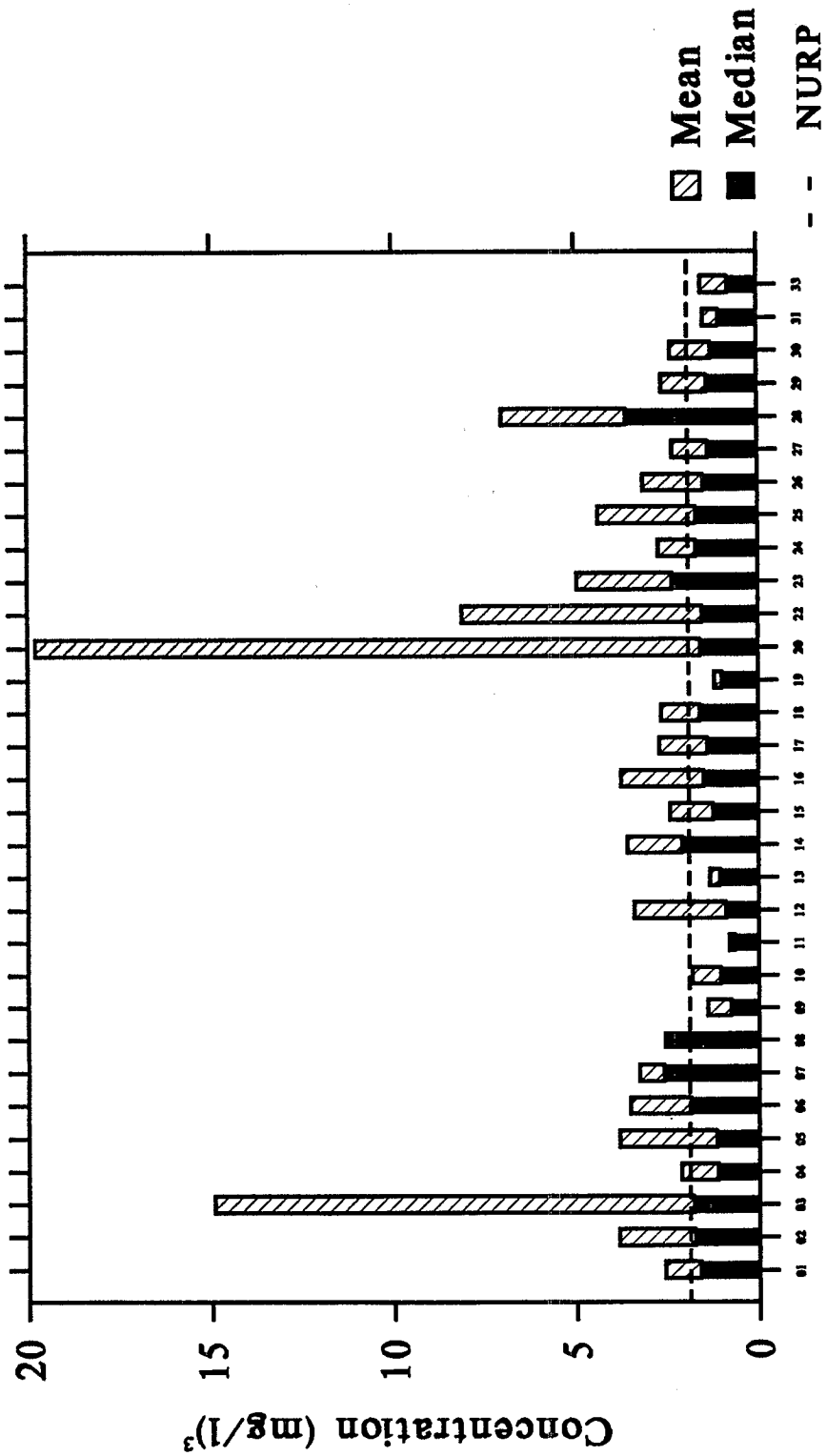
1. Based upon part 2 group application data submitted by Jan 1, 1992
2. See Table 1 for List of Industry Sectors by number
3. Values reported as Nondetect were assumed to be 0.0 mg/l

Figure F-12. Nitrate Plus Nitrite Nitrogen Concentration Storm Water Discharges[1] Composite Samples by Industry Sector

Table F-4
Summary of Sampling Data From Phase I Part II Permit Applications (With Comparison to NURP and USGS Studies) for TKN (mg/l)

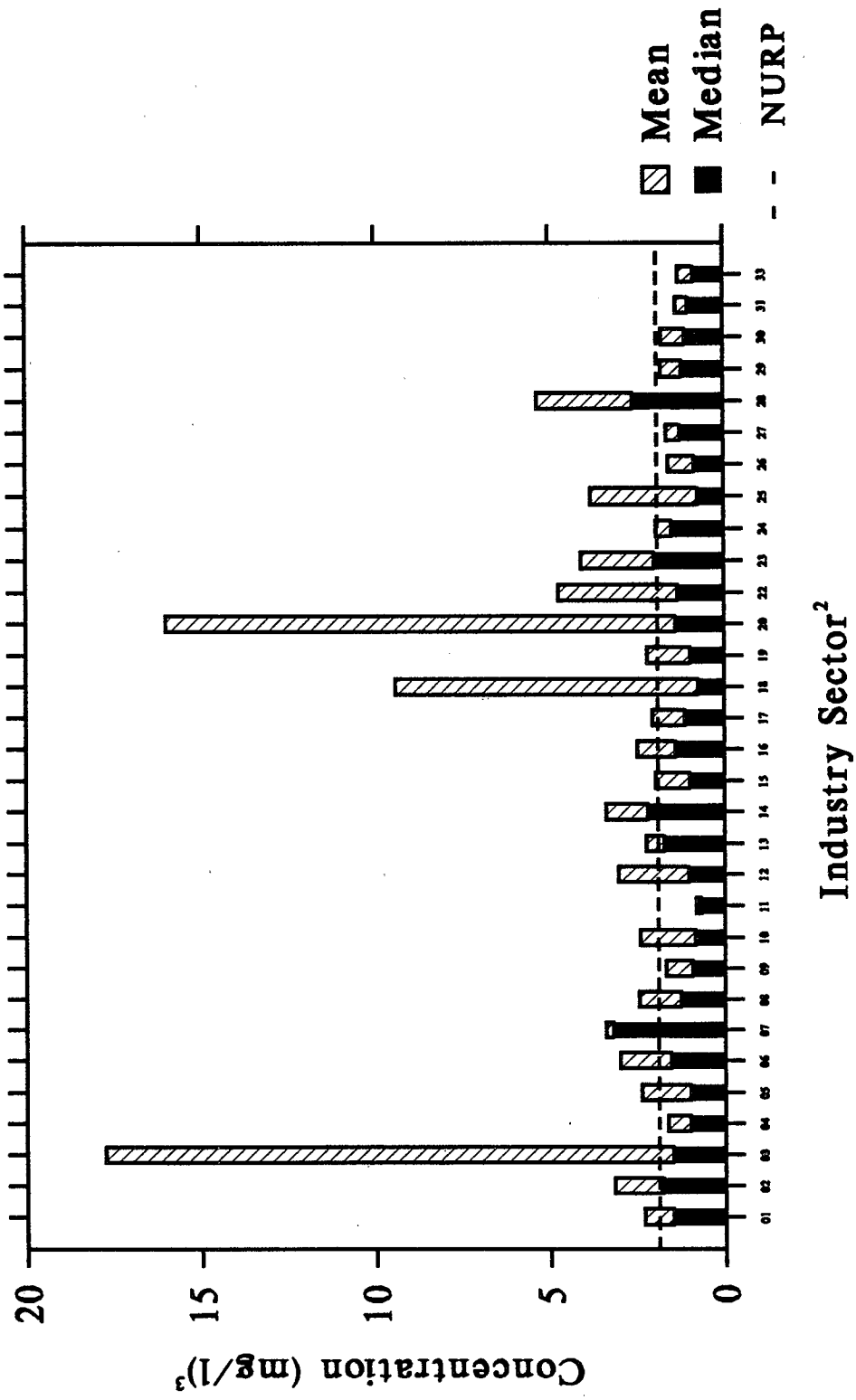
		Grab Samples				Composite Samples			
Sector	DESCRIPTION	No.	Mean	Median	95 %	No.	Mean	Median	95 %
	FOR POLLUTANT	TKN				TKN			
NURP	Median Urban Site *						1.90	1.50	3.30
USGS	Commercial Site *						NR	NR	NR
01	Lumber & Wood Products	188	2.57	1.62	9.26	188	2.32	1.50	7.50
02	Paper & Allied Prod.	121	3.83	1.76	10.20	112	3.17	1.77	10.10
03	Chemicals & Allied Products	171	15.50	1.90	27.00	159	18.30	1.70	23.70
04	Petrol Refining & Related Ind.	63	2.13	1.13	7.16	51	1.63	0.99	6.28
05	Stone, Clay, Glass Products	304	3.82	1.16	7.00	292	2.37	1.00	5.00
06	Primary Metal Ind.	160	3.56	1.98	13.00	149	3.05	1.60	9.70
07	Metal Mining	15	3.27	2.60	9.40	13	3.39	3.20	11.80
08	Coal & Lignite Mining	9	2.56	2.60	5.20	8	2.65	1.46	7.40
09	Oil & Gas Extraction	36	1.39	0.76	5.20	30	1.69	0.93	5.67
10	Nonmetallic Mineral Mining	55	1.81	1.05	8.00	50	2.41	0.84	6.89
11	Hazardous Waste TSDFs	9	1.43	1.30	3.00	9	1.07	0.92	3.92
12	Industrial Landfills & Dumps	51	3.36	1.10	12.00	48	3.03	1.04	14.20
13	Used Motor Vehicle Parts	13	2.17	1.90	4.87	30	2.27	1.77	6.63
14	Scrap & Waste Materials	127	3.44	2.05	11.10	114	3.38	2.20	9.20
15	Steam Electric Power Plants	76	2.41	1.25	8.55	78	1.95	1.00	10.00
16	Railroad Transport	118	3.75	1.50	13.40	102	2.48	1.40	8.80
17	Transport: Trucks, Freight, etc.	405	2.69	1.40	7.70	373	2.04	1.13	6.30
18	Water Transport	15	2.64	1.60	16.00	14	9.41	0.75	118.00
19	Ship & Boat Building, Repair	51	1.19	1.00	2.40	43	2.20	0.97	3.90
20	Air Transport	95	19.79	1.58	27.00	88	16.00	1.40	18.80
22	Wastewater Treatment	79	8.10	1.52	18.00	78	4.74	1.33	11.00
23	Food, Tobacco Manufact.	300	4.95	2.35	18.00	290	4.07	2.00	17.00
24	Textile & Apparel Manufact.	110	2.72	1.70	6.50	107	1.92	1.50	5.40
25	Furniture & Fixtures	25	4.37	1.70	15.00	24	4.40	1.35	13.00
26	Printing & Publishing	27	3.13	1.50	10.00	27	1.57	0.84	4.60
27	Rubber & Plastic Products	89	2.34	1.36	6.00	86	1.63	1.25	4.70
28	Leather/Products	31	7.70	4.30	22.00	31	6.22	3.50	15.00
29	Fabricated Metal Products, Jewelry	115	2.61	1.37	7.20	114	1.78	1.20	5.75
30	Ind. & Comm. & Transport Equip.	170	2.47	1.30	5.80	165	1.81	1.10	4.75
31	Electronic Equip. & Instruments	62	1.46	1.05	4.09	56	1.36	1.01	3.70

*NURP and USGS results were reported only as composite samples, not grab.
NR = Not Reported



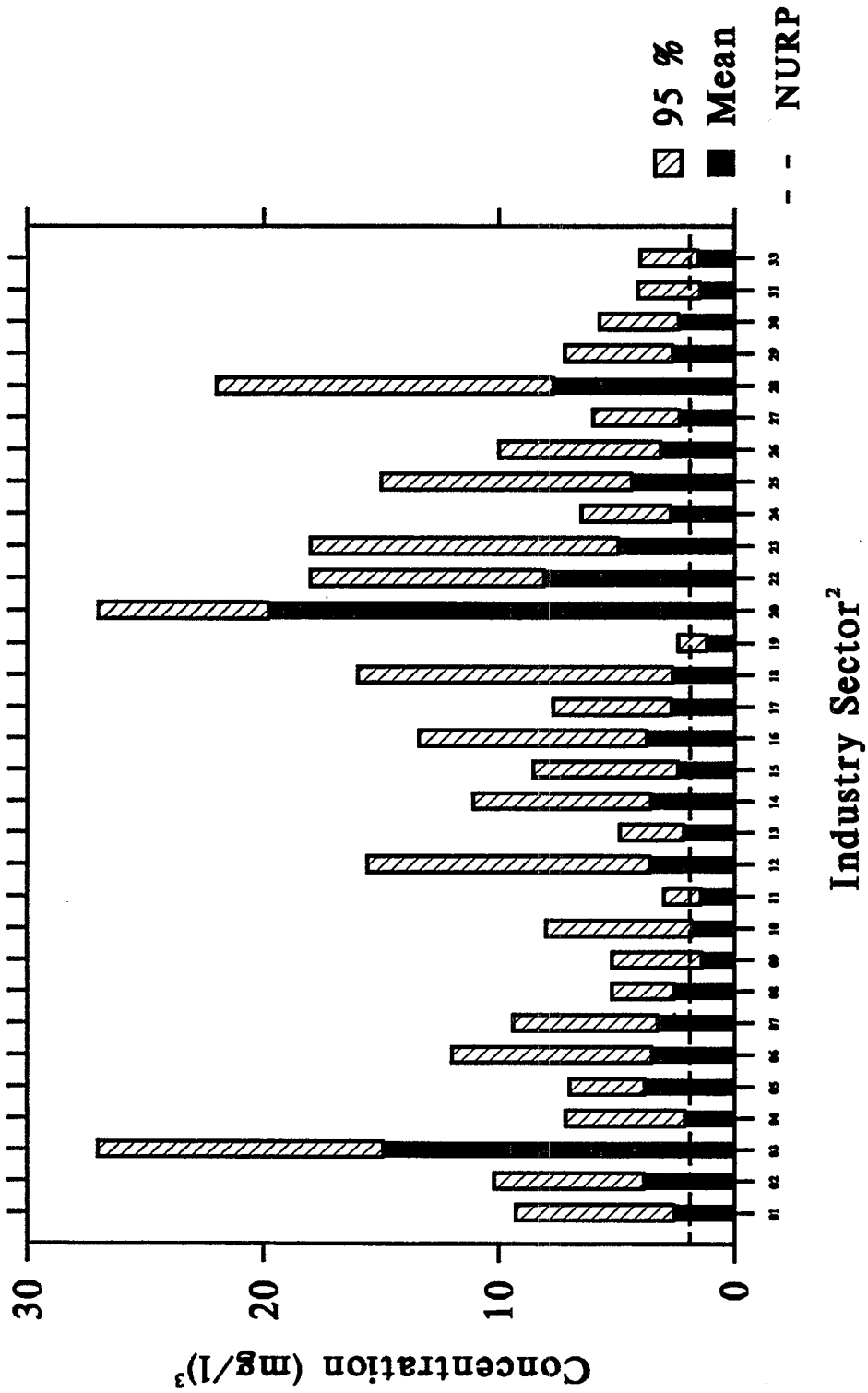
1. Based upon part 2 group application data submitted by Jan 1, 1992
2. See Table 1 for List of Industry Sectors by number
3. Values reported as Nondetect were assumed to be 0.0 mg/l

Figure F-13. TKN Concentration Storm Water Discharges[1] Grab Samples by Industry Sector



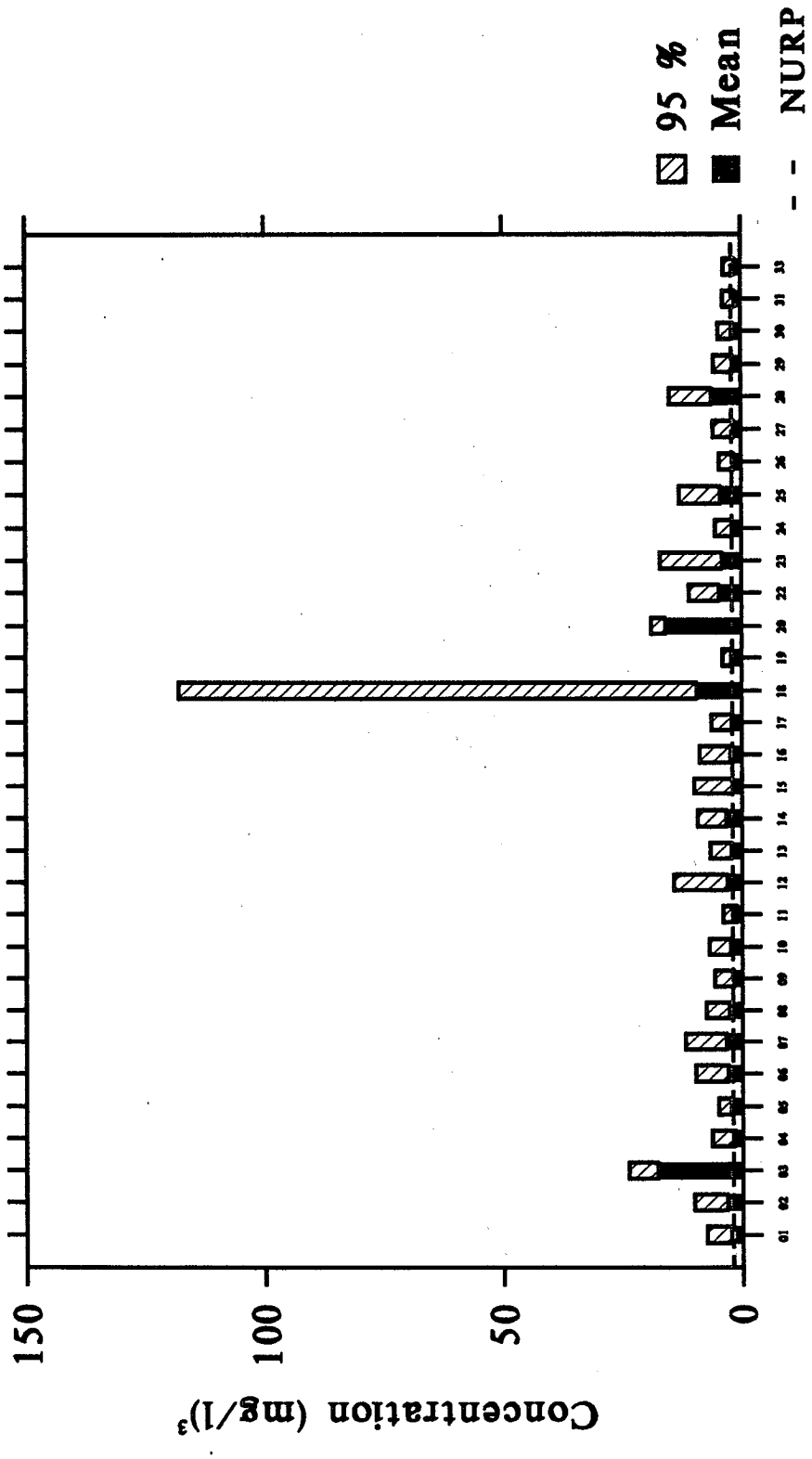
1. Based upon part 2 group application data submitted by Jan 1. 1992
2. See Table 1 for List of Industry Sectors by number
3. Values reported as Nondetect were assumed to be 0.0 mg/l

Figure F-14. TKN Concentration Storm Water Discharges[1]
Composite Samples by Industry Sector



1. Based upon part 2 group application data submitted by Jan 1, 1992
2. See Table 1 for List of Industry Sectors by number
3. Values reported as Nondetect were assumed to be 0.0 mg/l

Figure F-15. TKN Concentration Storm Water Discharges[1]
Grab Samples by Industry Sector



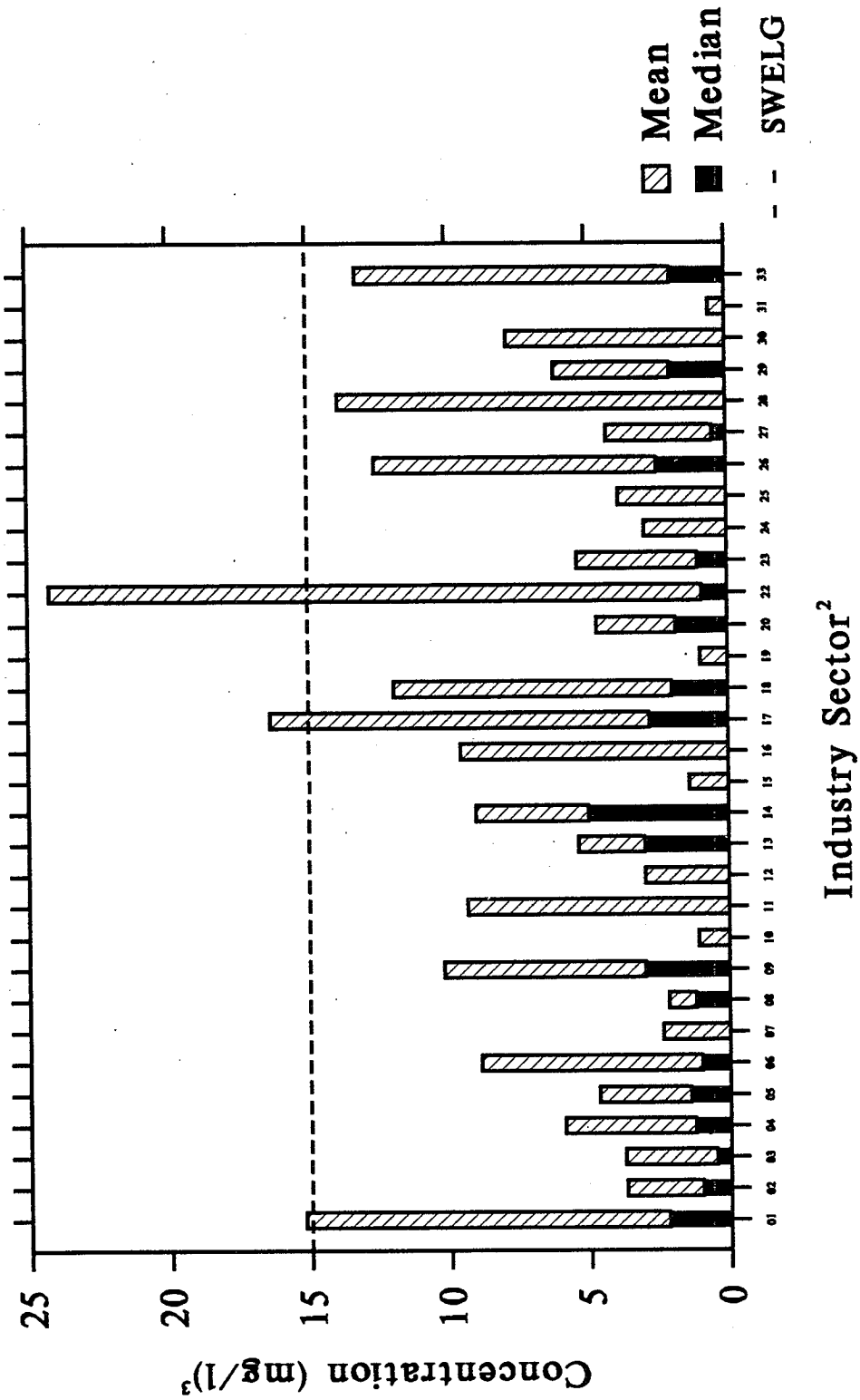
1. Based upon part 2 group application data submitted by Jan 1. 1992
2. See Table 1 for List of Industry Sectors by number
3. Values reported as Nondetect were assumed to be 0.0 mg/l

Figure F-16. TKN Concentration Storm Water Discharges[1]
Composite Samples by Industry Sector

Table F-5
Summary of Sampling Data From Phase I Part II Permit Applications (With Comparison to NURP and USGS Data) for Oil and Grease (mg/l)

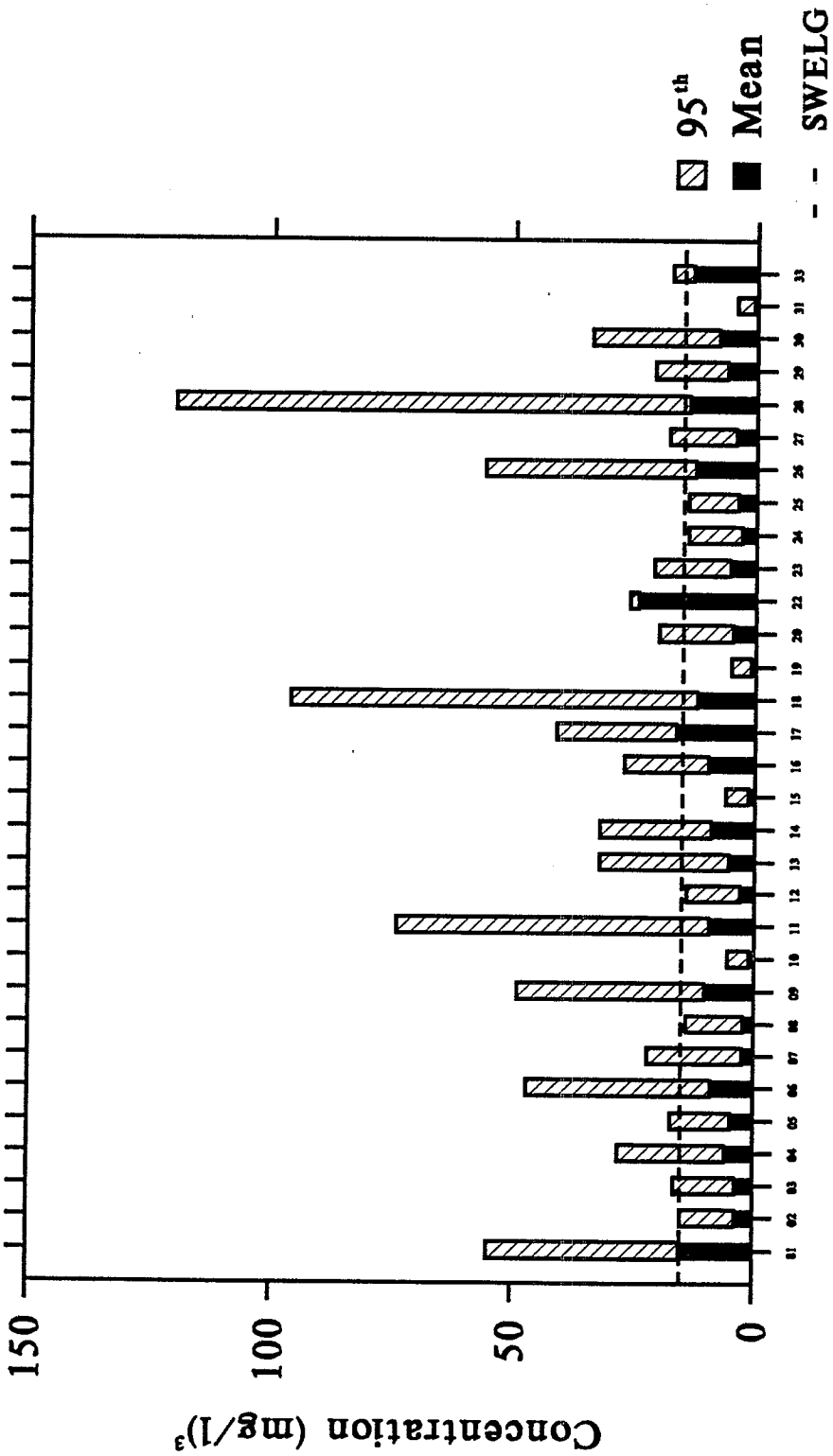
		Grab Samples				Composite Samples			
Sector	DESCRIPTION	No.	Mean	Median	95 %	No.	Mean	Median	95 %
	FOR POLLUTANT	Oil & Grease				Oil & Grease			
NURP	Median Urban Site *						NR	NR	NR
USGS	Commercial Site *						NR	NR	NR
01	Lumber & Wood Products	207	15.21	2.20	55.00				
02	Paper & Allied Prod.	122	3.69	1.00	15.00				
03	Chemicals & Allied Products	169	3.75	0.50	16.30				
04	Petrol Refining & Related Ind.	64	5.89	1.25	28.00				
05	Stone, Clay, Glass Products	315	4.67	1.40	17.10				
06	Primary Metal Ind.	163	8.88	1.00	47.00				
07	Metal Mining	16	2.36	0.00	22.00				
08	Coal & Lignite Mining	19	2.17	1.20	13.90				
09	Oil & Gas Extraction	36	10.18	3.00	49.00				
10	Nonmetallic Mineral Mining	60	1.08	0.00	5.45				
11	Hazardous Waste TSDFs	9	9.33	0.00	74.00				
12	Industrial Landfills & Dumps	53	2.97	0.00	14.00				
13	Used Motor Vehicle Parts	30	5.35	3.00	32.00				
14	Scrap & Waste Materials	135	8.95	5.00	32.00				
15	Steam Electric Power Plants	88	1.38	0.00	6.00				
16	Railroad Transport	118	9.56	0.00	27.00				
17	Transport: Trucks, Freight, etc.	418	16.38	2.80	41.00				
18	Water Transport	15	11.93	2.00	96.00				
19	Ship & Boat Building, Repair	52	0.98	0.00	5.00				
20	Air Transport	98	4.66	1.85	20.00				
22	Wastewater Treatment	89	24.24	0.90	26.00				
23	Food, Tobacco Manufact.	300	5.35	1.05	20.95				
24	Textile & Apparel Manufact.	111	2.94	0.00	14.00				
25	Furniture & Fixtures	25	3.84	0.00	14.00				
26	Printing & Publishing	27	12.58	2.50	56.00				
27	Rubber & Plastic Products	94	4.26	0.50	18.00				
28	Leather/Products	31	13.87	0.00	120.00				
29	Fabricated Metal Products, Jewelry	114	6.11	2.00	21.00				
30	Ind. & Comm. & Transport Equip.	189	7.84	0.00	34.00				
31	Electronic Equip. & Instruments	69	0.58	0.00	4.10				

*NURP and USGS results were reported only as composite samples, not grab.
NR = Not Reported



1. Based upon part 2 group application data submitted by Jan 1, 1992
2. See Table 1 for List of Industry Sectors by number
3. Values reported as Nondetect were assumed to be 0.0 mg/l

Figure F-17. Oil & Grease Concentration Storm Water Discharges[1]
Grab Samples by Industry Sector



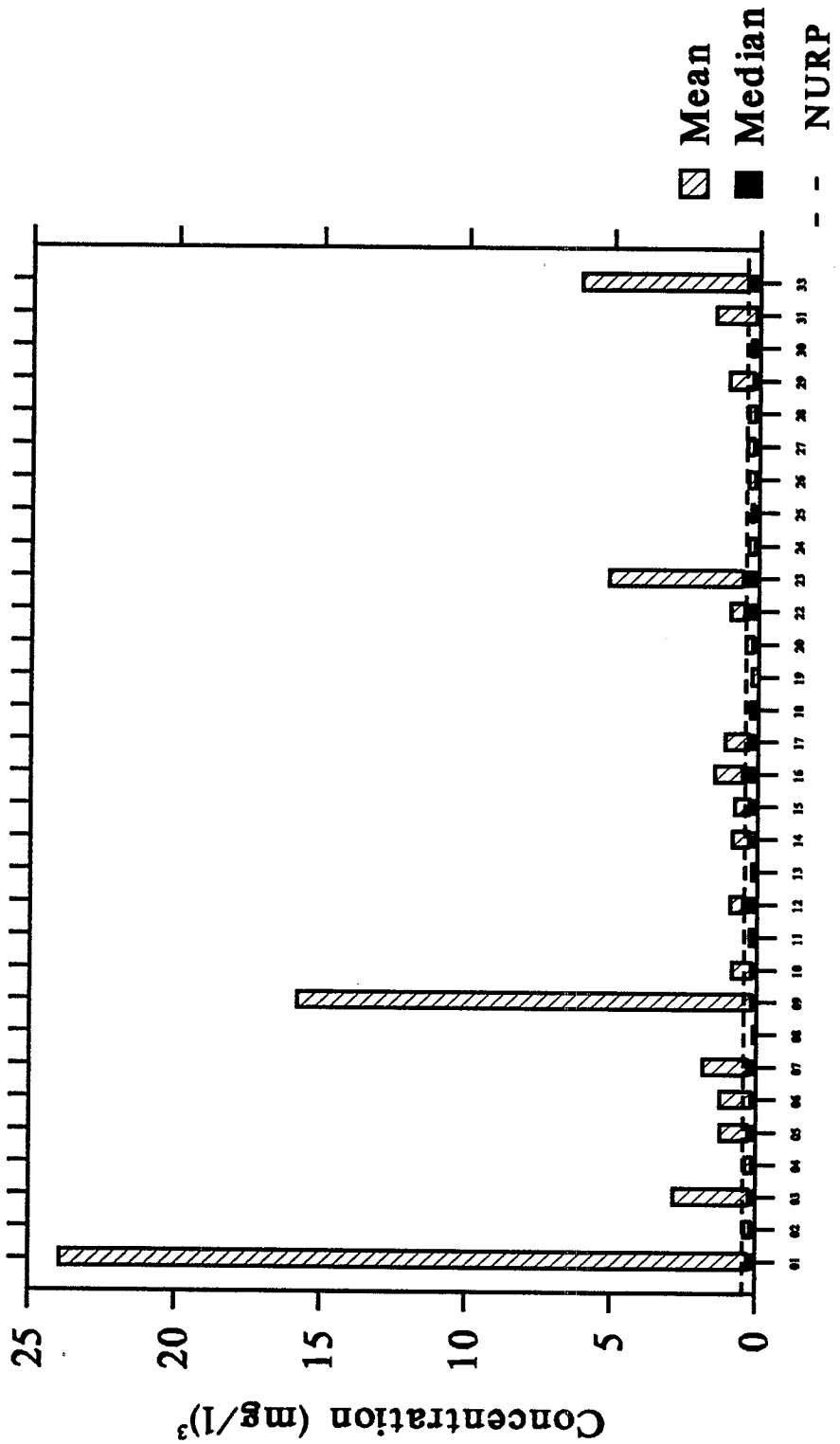
1. Based upon part 2 group application data submitted by Jan 1, 1992
2. See Table 1 for List of Industry Sectors by number
3. Values reported as Nondetect were assumed to be 0.0 mg/l

Figure F-18. Oil & Grease Concentration Storm Water Discharges[1] Grab Samples by Industry Sector

Table F-6
Summary of Sampling Data From Phase I Part II Permit Applications (With Comparison to NURP and USGS Data) for Total Phosphorus (mg/l)

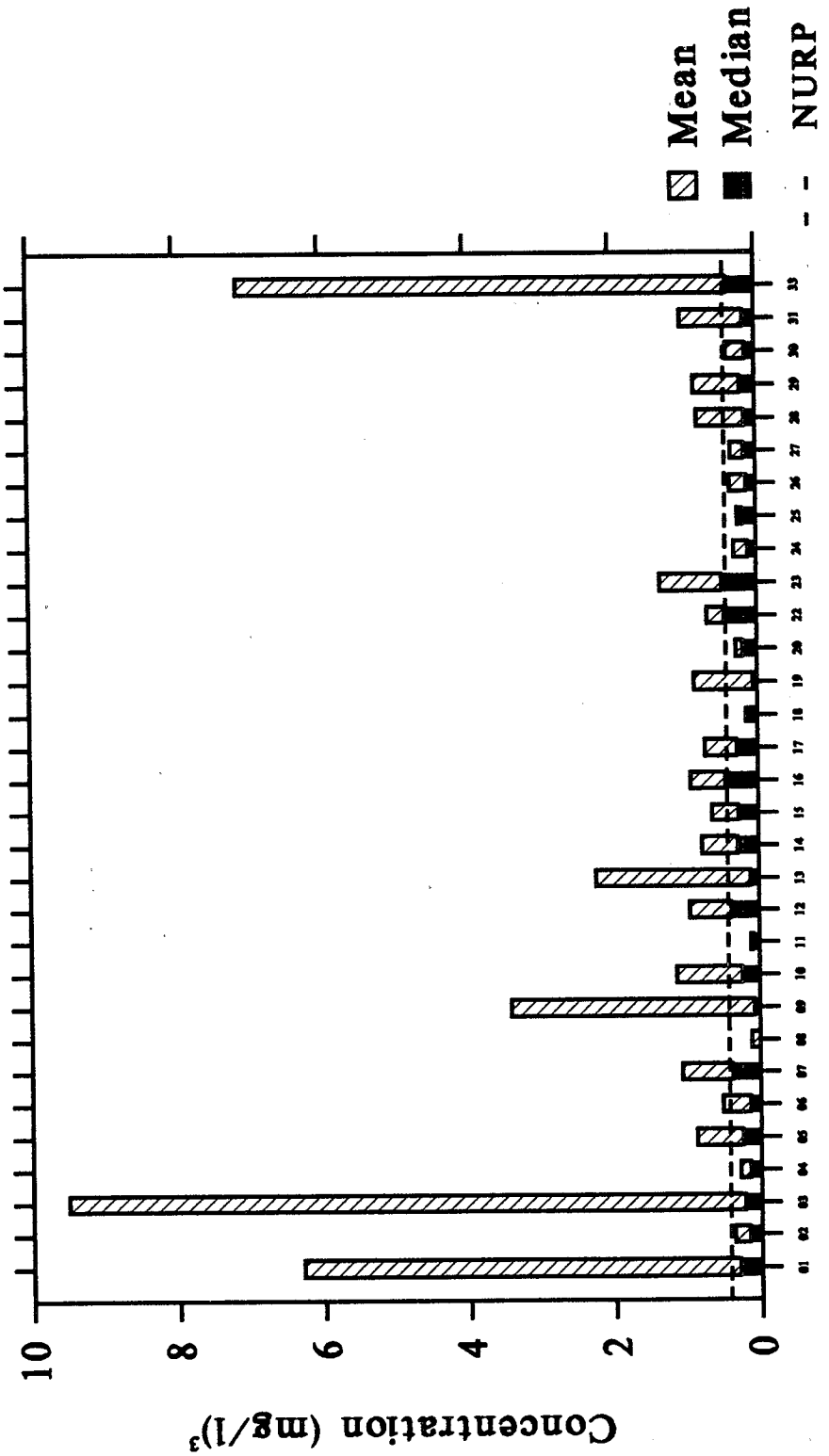
Sector	DESCRIPTION	Grab Samples				Composite Samples			
		No.	Mean	Median	95 %	No.	Mean	Median	95 %
	FOR POLLUTANT	P, Total				P, Total			
NURP	Median Urban Site *						0.42	0.33	0.70
USGS	Commercial Site *						0.31	0.18	NR
01	Lumber & Wood Products	198	23.91	0.29	2.66	199	6.29	0.30	1.72
02	Paper & Allied Prod.	120	0.39	0.18	1.06	111	0.36	0.16	0.91
03	Chemicals & Allied Products	170	2.82	0.24	12.10	158	9.51	0.23	16.40
04	Petrol Refining & Related Ind.	63	0.37	0.13	1.65	54	0.28	0.15	1.28
05	Stone, Clay, Glass Products	313	1.21	0.28	4.96	300	0.87	0.25	3.24
06	Primary Metal Ind.	163	1.25	0.17	1.80	149	0.52	0.14	0.96
07	Metal Mining	21	1.83	0.30	11.00	16	1.06	0.38	7.00
08	Coal & Lignite Mining	8	0.12	0.04	0.66	5	0.12	0.00	0.58
09	Oil & Gas Extraction	36	15.82	0.18	144.90	33	3.41	0.07	19.46
10	Nonmetallic Mineral Mining	55	0.84	0.20	4.69	51	1.13	0.24	2.61
11	Hazardous Waste TSDFs	9	0.24	0.07	1.60	9	0.11	0.09	0.32
12	Industrial Landfills & Dumps	50	0.91	0.50	3.35	47	0.95	0.38	4.08
13	Used Motor Vehicle Parts	13	0.19	0.05	1.08	30	3.05	0.26	15.70
14	Scrap & Waste Materials	127	0.81	0.30	2.20	114	0.77	0.29	1.80
15	Steam Electric Power Plants	75	0.79	0.29	3.09	78	0.63	0.27	3.10
16	Railroad Transport	118	1.47	0.54	8.10	102	0.92	0.45	3.05
17	Transport: Trucks, Freight, etc.	405	1.12	0.33	3.90	373	0.73	0.29	2.91
18	Water Transport	15	0.27	0.10	1.20	14	0.15	0.17	0.32
19	Ship & Boat Building, Repair	51	0.21	0.00	0.91	45	0.88	0.00	0.76
20	Air Transport	86	0.44	0.20	1.84	79	0.29	0.20	0.88
22	Wastewater Treatment	86	0.95	0.50	3.17	84	0.68	0.45	1.89
23	Food, Tobacco Manufact.	298	5.13	0.56	9.06	287	1.32	0.48	5.96
24	Textile & Apparel Manufact.	110	0.35	0.14	0.66	107	0.31	0.11	0.60
25	Furniture & Fixtures	25	0.27	0.20	0.89	24	0.26	0.19	0.71
26	Printing & Publishing	27	0.37	0.14	1.50	27	0.35	0.13	1.30
27	Rubber & Plastic Products	89	0.41	0.19	1.61	85	0.34	0.16	0.83
28	Leather/Products	31	0.36	0.16	1.60	31	0.83	0.18	1.30
29	Fabricated Metal Products, Jewelry	113	1.03	0.22	9.80	114	0.84	0.21	4.80
30	Ind. & Comm. & Transport Equip.	176	0.29	0.14	1.00	179	0.40	0.13	1.12
31	Electronic Equip. & Instruments	64	1.50	0.13	1.10	57	1.02	0.16	1.20

*NURP and USGS results were reported only as composite samples, not grab.
NR = Not Reported



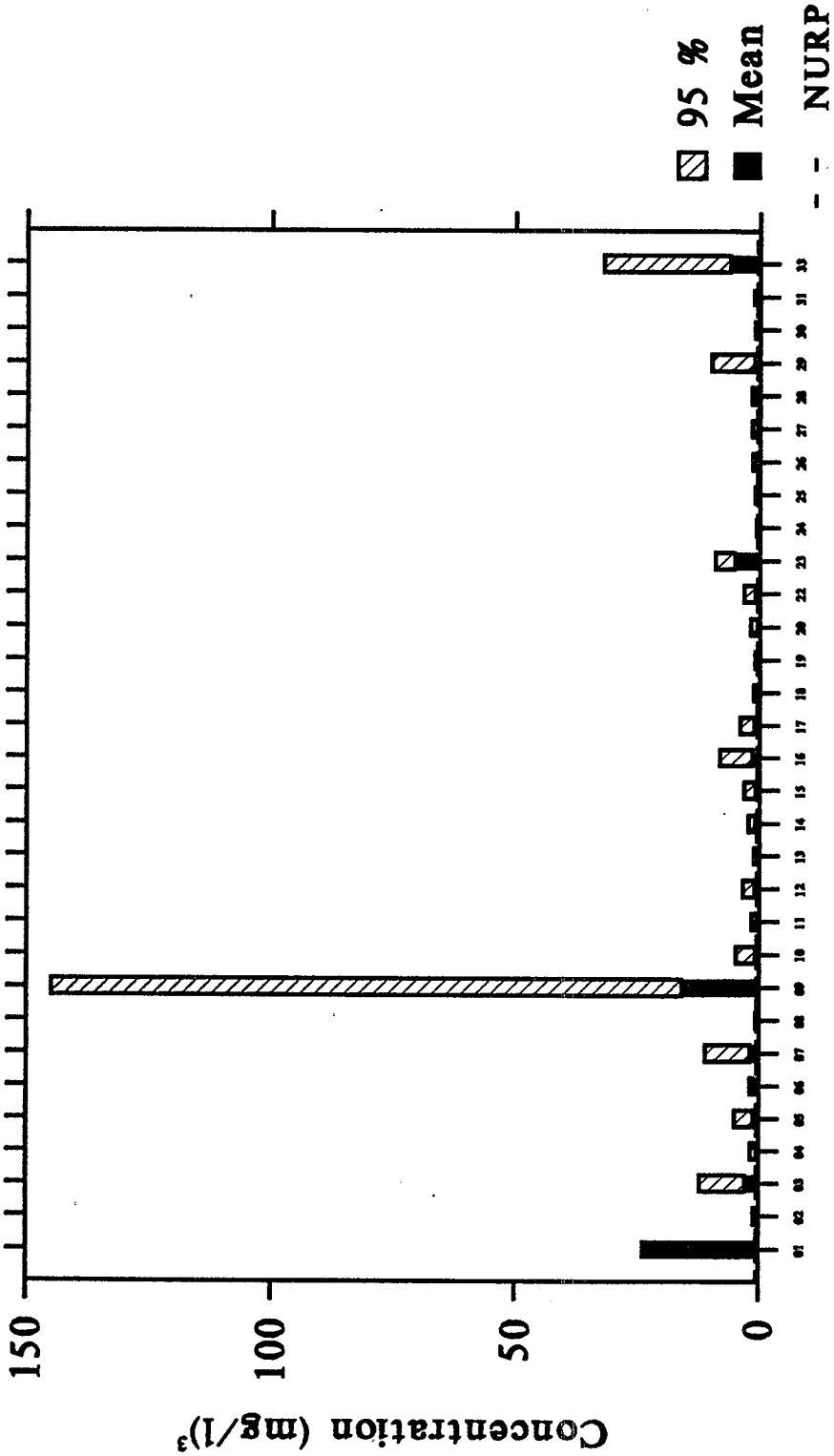
1. Based upon part 2 group application data submitted by Jan 1. 1992
2. See Table 1 for List of Industry Sectors by number
3. Values reported as Nondetect were assumed to be 0.0 mg/l

Figure F-19. Phosphorus Concentration Storm Water Discharges[1]
Grab Samples by Industry Sector



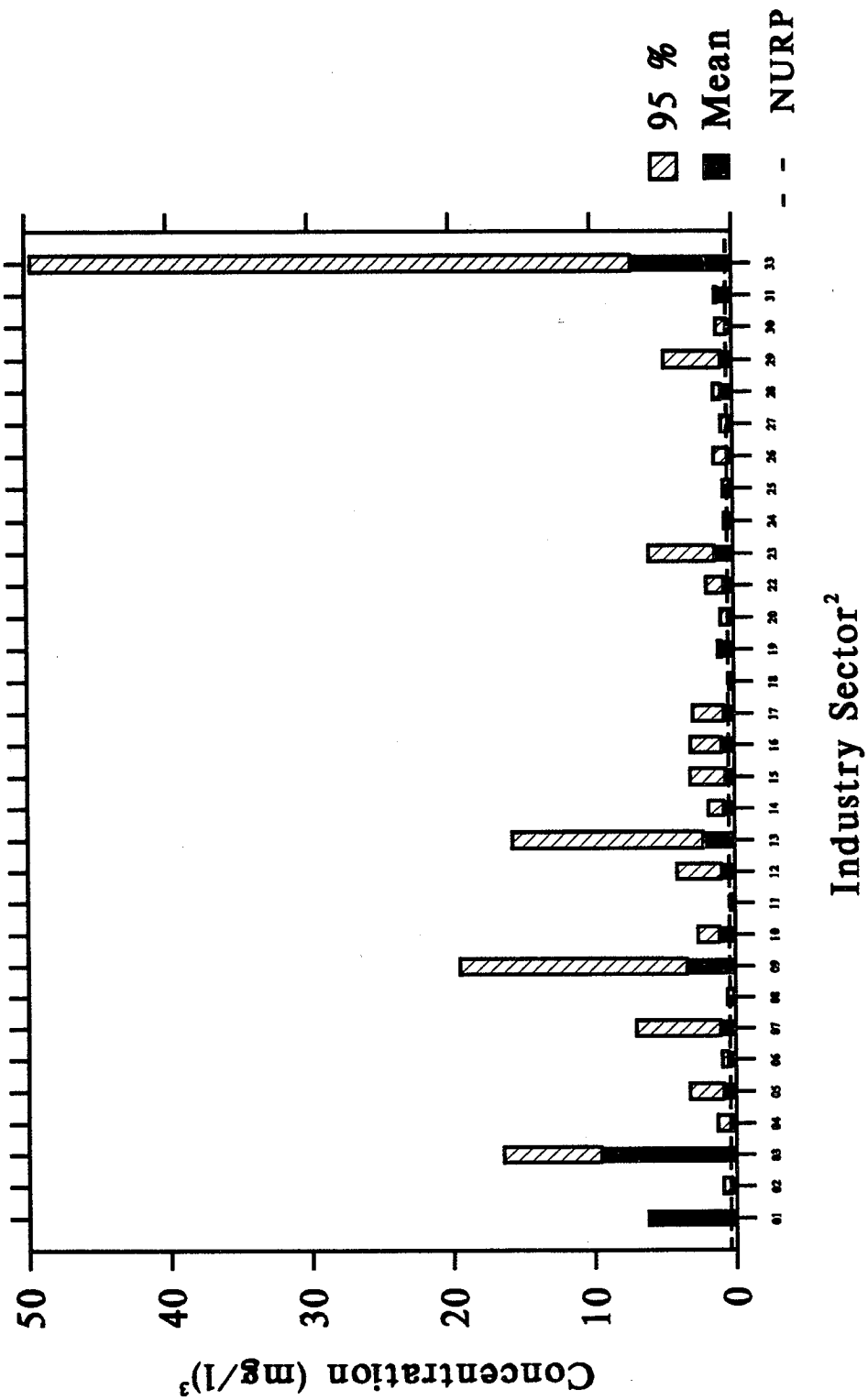
1. Based upon part 2 group application data submitted by Jan 1, 1992
2. See Table 1 for List of Industry Sectors by number
3. Values reported as Nondetect were assumed to be 0.0 mg/l

Figure F-20. Phosphorus Concentration Storm Water Discharges[1] Composite Samples by Industry Sector



1. Based upon part 2 group application data submitted by Jan 1. 1992
2. See Table 1 for List of Industry Sectors by number
3. Values reported as Nondetect were assumed to be 0.0 mg/l

Figure F-21. Phosphorus Concentration Storm Water Discharges[1]
Grab Samples by Industry Sector



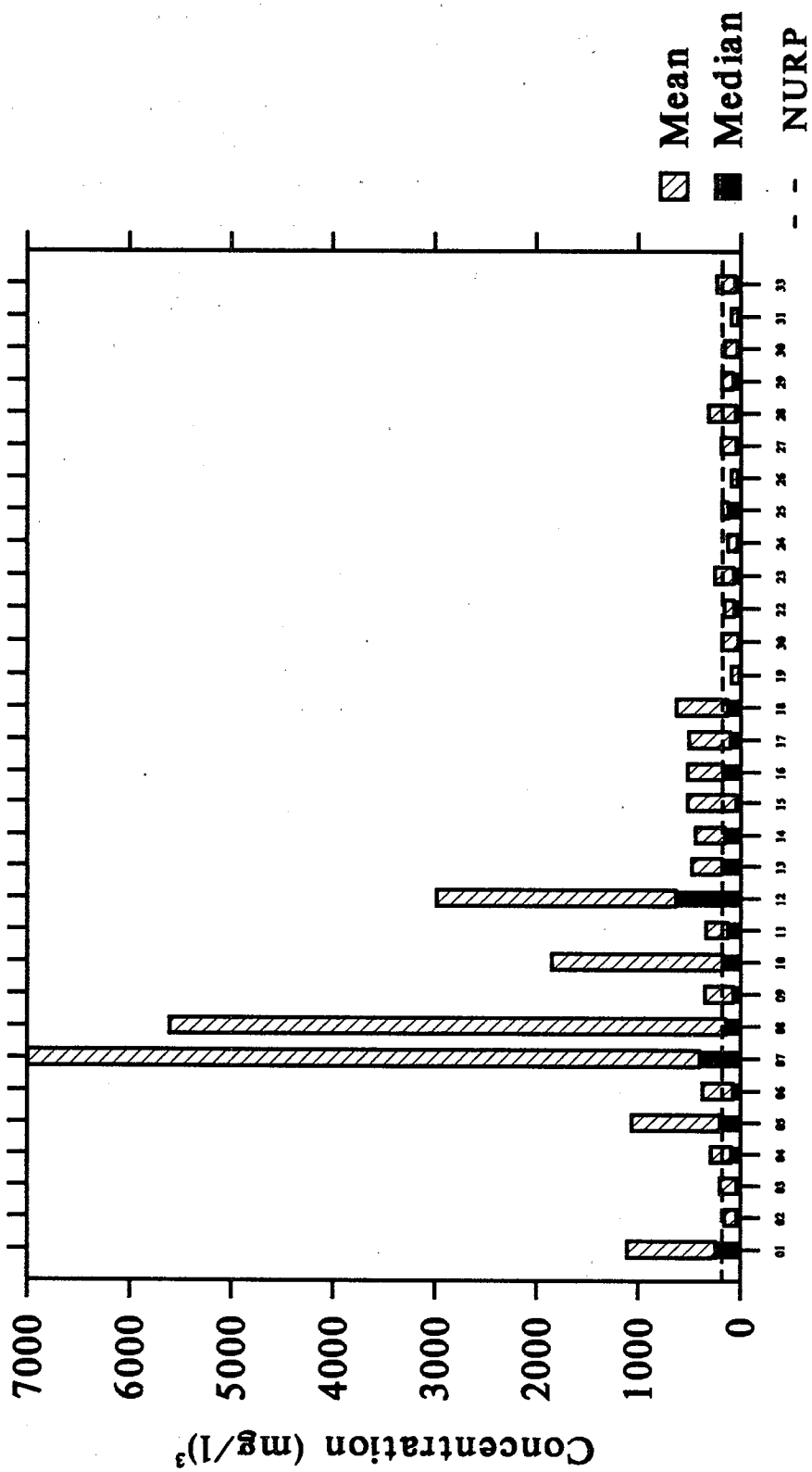
1. Based upon part 2 group application data submitted by Jan 1, 1992
2. See Table 1 for List of Industry Sectors by number
3. Values reported as Nondetect were assumed to be 0.0 mg/l

Figure F-22. Phosphorus Concentration Storm Water Discharges[1] Composite Samples by Industry Sector

Table F-7
Summary of Sampling Data From Phase I Part II Permit Applications (With Comparison to NURP and USGS Studies) for TSS (mg/l)

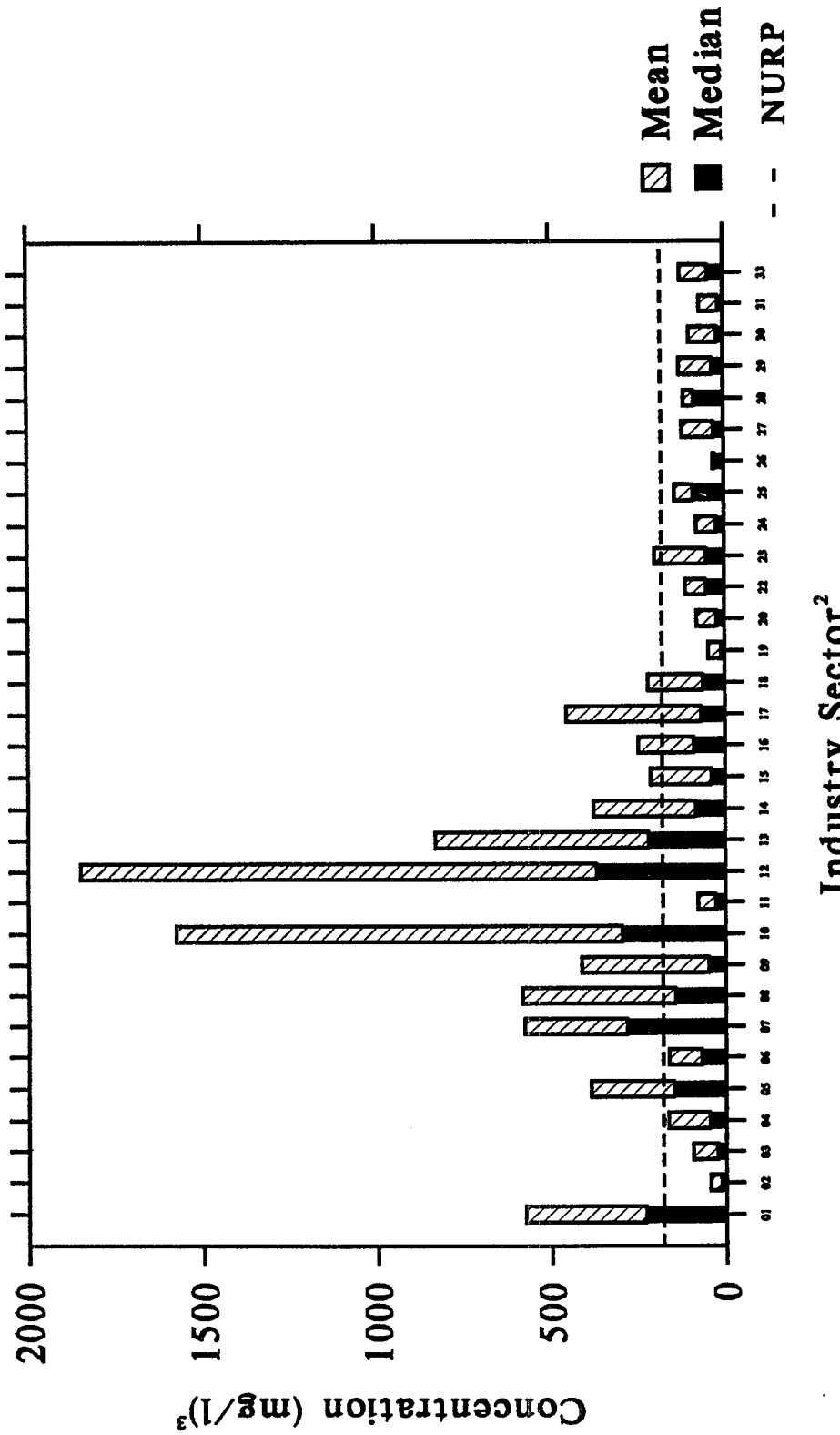
		Grab Samples				Composite Samples			
Sector	DESCRIPTION	No.	Mean	Median	95 %	No.	Mean	Median	95 %
	FOR POLLUTANT	TSS				TSS			
NURP	Median Urban Site *						180	100	300
USGS	Commercial Site *						248	109	NR
01	Lumber & Wood Products	198	1108	242	4800	198	575	230	2288
02	Paper & Allied Prod.	121	153	41	520	111	44	13	198
03	Chemicals & Allied Products	169	200	40	793	159	94	25	453
04	Petrol Refining & Related Ind.	63	287	93	1330	54	165	46	860
05	Stone, Clay, Glass Products	311	1067	200	2620	302	386	149	1440
06	Primary Metal Ind.	162	368	72	1700	149	162	69	717
07	Metal Mining	17	6996	403	100000	15	623	330	3050
08	Coal & Lignite Mining	10	5608	150	33420	8	690	251	3880
09	Oil & Gas Extraction	37	353	75	1520	30	413	48	2056
10	Nonmetallic Mineral Mining	55	1848	181	11120	51	1576	296	10080
11	Hazardous Waste TSDFs	8	338	128	1100	9	83	32	304
12	Industrial Landfills & Dumps	51	2979	633	19370	47	1850	370	9140
13	Used Motor Vehicle Parts	13	474	183	2300	30	839	226	5100
14	Scrap & Waste Materials	130	437	148	2096	116	376	85	1700
15	Steam Electric Power Plants	76	516	44	1200	77	212	40	810
16	Railroad Transport	118	517	172	2800	102	249	90	917
17	Transport: Trucks, Freight, etc.	406	503	104	1890	375	454	67	1100
18	Water Transport	15	634	135	4330	14	224	68	944
19	Ship & Boat Building, Repair	51	92	17	505	45	2	8	200
20	Air Transport	96	185	29	1080	87	80	22	258
22	Wastewater Treatment	90	160	68	575	88	114	56	414
23	Food, Tobacco Manufact.	298	252	73	1320	286	200	54	900
24	Textile & Apparel Manufact.	110	126	36	410	107	80	22	380
25	Furniture & Fixtures	25	188	130	440	24	143	91	550
26	Printing & Publishing	27	92	30	433	27	31	28	82
27	Rubber & Plastic Products	90	189	44	893	87	119	30	476
28	Leather/Products	31	310	49	1300	31	115	86	460
29	Fabricated Metal Products, Jewelry	115	187	76	758	114	125	32	423
30	Ind. & Comm. & Transport Equip.	173	163	30	576	169	100	17	319
31	Electronic Equip. & Instruments	63	89	29	348	56	67	14	370

*NURP and USGS results were reported only as composite samples, not grab.
NR = Not Reported



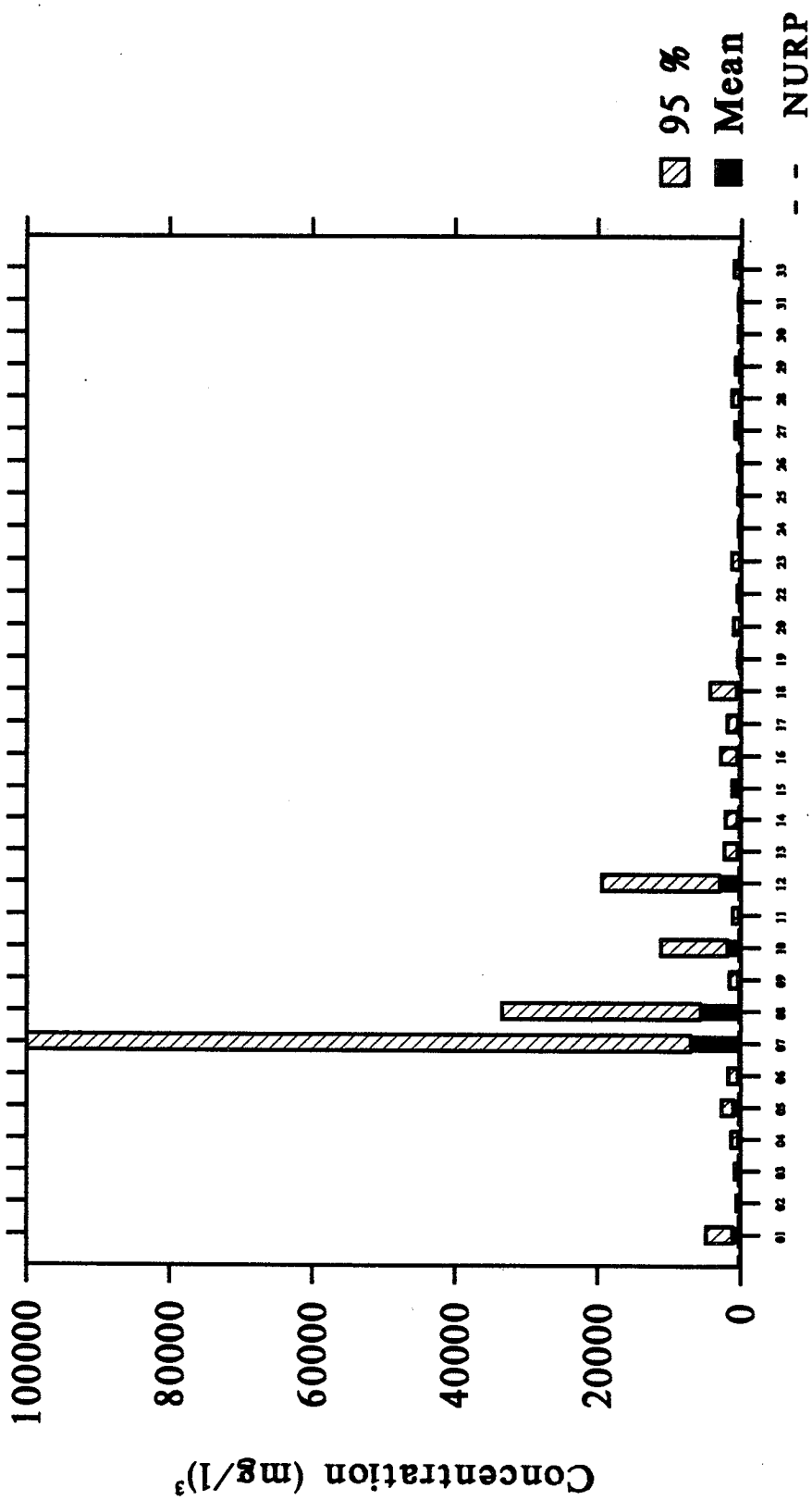
1. Based upon part 2 group application data submitted by Jan 1, 1992
2. See Table 1 for List of Industry Sectors by number
3. Values reported as Nondetect were assumed to be 0.0 mg/l

Figure F-23. TSS Concentration Storm Water Discharges[1] Grab Samples by Industry Sector



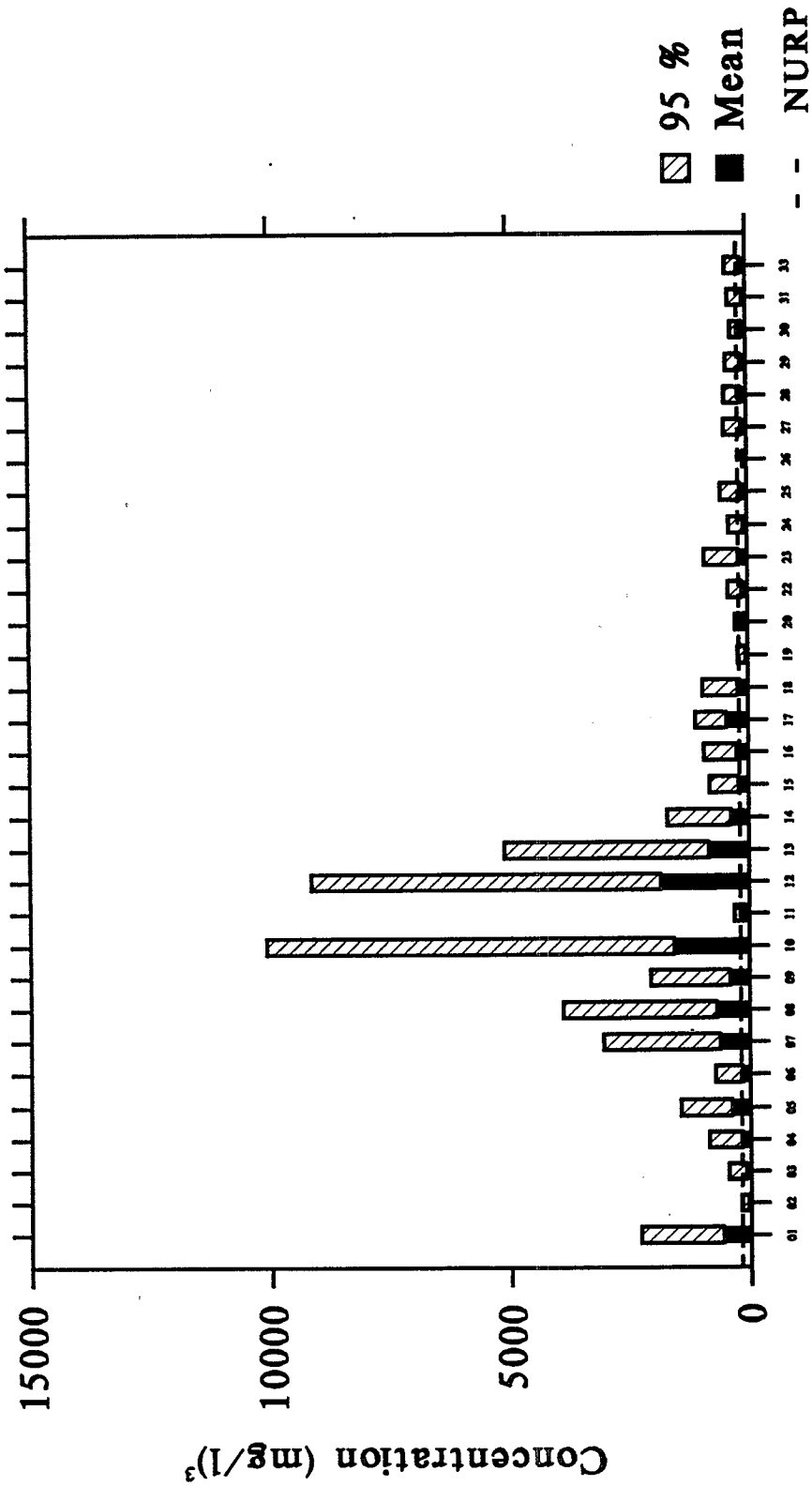
1. Based upon part 2 group application data submitted by Jan 1, 1992
2. See Table 1 for List of Industry Sectors by number
3. Values reported as Nondetect were assumed to be 0.0 mg/l

Figure F-24. TSS Concentration Storm Water Discharges[1] Composite Samples by Industry Sector



1. Based upon part 2 group application data submitted by Jan 1, 1992
2. See Table 1 for List of Industry Sectors by number
3. Values reported as Nondetect were assumed to be 0.0 mg/l

Figure F-25. TSS Concentration Storm Water Discharges[1] Grab Samples by Industry Sector



1. Based upon part 2 group application data submitted by Jan 1. 1992
2. See Table 1 for List of Industry Sectors by number
3. Values reported as Nondetect were assumed to be 0.0 mg/l

Figure F-26. TSS Concentration Storm Water Discharges[1]
Composite Samples by Industry Sector

Table F-8
Summary of Sampling Data From Phase I Part II Permit Applications (With Comparison to NURP and USGS Studies) for Copper (mg/l)

		Grab Samples				Composite Samples			
Sector	DESCRIPTION	No.	Mean	Median	95 %	No.	Mean	Median	95 %
	FOR POLLUTANT	Copper				Copper			
NURP	Median Urban Site *						0.04	0.04	0.09
USGS	Commercial Site *						0.03	0.02	NR
01	Lumber & Wood Products	32	0.05	0.03	0.16	29	0.04	0.03	0.12
02	Paper & Allied Prod.	2	0.03	0.03	0.05	2	0.03	0.03	0.07
03	Chemicals & Allied Products	51	0.19	0.01	0.21	46	0.12	0.00	0.19
04	Petrol Refining & Related Ind.								
05	Stone, Clay, Glass Products	6	0.13	0.02	0.40	5	0.16	0.04	0.40
06	Primary Metal Ind.	143	3.46	0.10	3.40	131	2.25	0.07	3.10
07	Metal Mining	19	3.88	0.14	46.80	13	0.59	0.09	3.40
08	Coal & Lignite Mining	1	0.00	0.00	0.00	2	0.00	0.00	0.00
09	Oil & Gas Extraction								
10	Nonmetallic Mineral Mining	6	0.05	0.01	0.15	4	0.01	0.01	0.01
11	Hazardous Waste TSDFs								
12	Industrial Landfills & Dumps								
13	Used Motor Vehicle Parts								
14	Scrap & Waste Materials	102	0.77	0.26	3.00	95	0.63	0.22	2.50
15	Steam Electric Power Plants	70	0.08	0.00	0.21	75	0.03	0.02	0.13
16	Railroad Transport								
17	Transport: Trucks, Freight, etc.	19	0.02	0.01	0.06	20	0.02	0.01	0.08
18	Water Transport								
19	Ship & Boat Building, Repair	5	0.16	0.15	0.32	5	0.08	0.09	0.13
20	Air Transport	2	0.03	0.03	0.04	3	0.01	0.01	0.02
22	Wastewater Treatment	28	0.07	0.01	0.22	27	0.05	0.02	0.11
23	Food, Tobacco Manufact.	17	0.08	0.04	0.27	17	0.05	0.03	0.24
24	Textile & Apparel Manufact.	16	0.03	0.01	0.15	14	0.07	0.01	0.61
25	Furniture & Fixtures	4	0.04	0.04	0.07	4	0.00	0.00	0.02
26	Printing & Publishing	7	0.03	0.03	0.08	6	0.02	0.03	0.04
27	Rubber & Plastic Products	5	0.00	0.00	0.01	5	0.03	0.05	0.05
28	Leather/Products								
29	Fabricated Metal Products, Jewelry	36	0.63	0.03	4.30	33	0.46	0.02	0.64
30	Ind. & Comm. & Transport Equip.	79	0.20	0.01	0.84	74	0.06	0.01	0.36
31	Electronic Equip. & Instruments	54	0.04	0.00	0.11	50	0.01	0.00	0.05

*NURP and USGS results were reported only as composite samples, not grab.
NR = Not Reported

Table F-9
Summary of Sampling Data From Phase I Part II Permit Applications (With Comparison to NURP and USGS Studies) for Lead (mg/l)

		Grab Samples				Composite Samples			
Sector	DESCRIPTION	No.	Mean	Median	95 %	No.	Mean	Median	95 %
	FOR POLLUTANT	Lead				Lead			
NURP	Median Urban Site *						0.18	0.14	0.35
USGS	Commercial Site *						0.22	0.07	NR
01	Lumber & Wood Products								
02	Paper & Allied Prod.	2	0.05	0.05	0.09	2	0.03	0.03	0.05
03	Chemicals & Allied Products	47	0.07	0.01	0.17	42	0.02	0.01	0.07
04	Petrol Refining & Related Ind.								
05	Stone, Clay, Glass Products	15	0.24	0.01	3.30	15	0.25	0.01	3.40
06	Primary Metal Ind.	136	0.78	0.02	1.41	123	0.19	0.02	1.00
07	Metal Mining	23	0.89	0.00	1.20	13	6.07	0.05	65.00
08	Coal & Lignite Mining	2	0.02	0.02	0.04	2	0.00	0.00	0.00
09	Oil & Gas Extraction								
10	Nonmetallic Mineral Mining	6	0.00	0.00	0.00	4	0.00	0.00	0.00
11	Hazardous Waste TSDFs								
12	Industrial Landfills & Dumps	9	9.62	0.08	83.70	7	20.64	0.18	143.00
13	Used Motor Vehicle Parts								
14	Scrap & Waste Materials	103	0.85	0.21	4.00	96	0.88	0.22	3.40
15	Steam Electric Power Plants	28	0.02	0.00	0.08	23	0.02	0.01	0.07
16	Railroad Transport								
17	Transport: Trucks, Freight, etc.	32	0.03	0.01	0.11	31	0.01	0.00	0.06
18	Water Transport	4	0.20	0.05	0.70	3	0.10	0.10	0.10
19	Ship & Boat Building, Repair	6	0.75	0.04	4.24	5	11.00	0.06	0.33
20	Air Transport	2	0.02	0.02	0.03	3	0.00	0.00	0.00
22	Wastewater Treatment	27	0.03	0.00	0.15	26	0.01	0.00	0.09
23	Food, Tobacco Manufact.	12	0.01	0.01	0.03	10	0.01	0.01	0.04
24	Textile & Apparel Manufact.	8	0.07	0.02	0.28	7	0.04	0.03	0.11
25	Furniture & Fixtures	3	0.08	0.06	0.16	3	0.01	0.01	0.02
26	Printing & Publishing	1	0.03	0.03	0.03	0			
27	Rubber & Plastic Products	1	0.00	0.00	0.00	1	0.01	0.01	0.01
28	Leather/Products	2	0.02	0.02	0.04	2	0.02	0.02	0.04
29	Fabricated Metal Products, Jewelry	32	0.11	0.00	0.89	30	0.06	0.00	0.22
30	Ind. & Comm. & Transport Equip.	76	0.22	0.00	0.97	75	0.18	0.00	0.94
31	Electronic Equip. & Instruments	60	0.02	0.00	0.08	56	0.01	0.00	0.04

*NURP and USGS results were reported only as composite samples, not grab.
NR = Not Reported

Table F-10
Summary of Sampling Data From Phase I Part II Permit Applications (With Comparison to NURP and USGS Studies) for Zinc (mg/l)

Sector	DESCRIPTION	Grab Samples				Composite Samples			
		No.	Mean	Median	95 %	No.	Mean	Median	95 %
	FOR POLLUTANT	Zinc				Zinc			
NURP	Median Urban Site *						0.20	0.16	0.50
USGS	Commercial Site *						0.31	0.11	NR
01	Lumber & Wood Products	16	0.47	0.37	1.70	15	0.36	0.30	1.20
02	Paper & Allied Prod.	1	0.62	0.62	0.62	1	0.78	0.78	0.78
03	Chemicals & Allied Products	75	2.11	0.24	7.70	70	1.74	0.24	4.20
04	Petrol Refining & Related Ind.								
05	Stone, Clay, Glass Products	8	0.35	0.14	1.17	7	0.39	0.18	1.12
06	Primary Metal Ind.	144	8.85	0.46	11.80	132	6.55	0.43	9.67
07	Metal Mining	14	3.04	0.59	16.30	8	3.87	0.66	20.90
08	Coal & Lignite Mining	2	0.17	0.17	0.30	2	0.06	0.06	0.09
09	Oil & Gas Extraction								
10	Nonmetallic Mineral Mining	5	0.18	0.18	0.34	3	0.29	0.30	0.30
11	Hazardous Waste TSDFs								
12	Industrial Landfills & Dumps								
13	Used Motor Vehicle Parts								
14	Scrap & Waste Materials	97	3.16	1.40	12.00	90	3.20	1.40	10.00
15	Steam Electric Power Plants	35	0.32	0.05	0.66	39	0.27	0.06	0.92
16	Railroad Transport	1	0.14	0.14	0.14	1	0.28	0.28	0.28
17	Transport: Trucks, Freight, etc.	30	0.23	0.13	1.10	28	1.34	0.11	0.66
18	Water Transport	4	0.68	0.22	2.20	3	0.42	0.21	0.87
19	Ship & Boat Building, Repair	2	0.31	0.31	0.36	1	39.00	0.33	0.33
20	Air Transport	8	0.14	0.08	0.58	3	0.35	0.04	1.00
22	Wastewater Treatment	23	0.23	0.06	0.75	22	0.12	0.06	0.43
23	Food, Tobacco Manufact.	33	0.78	0.21	2.10	31	0.79	0.24	5.83
24	Textile & Apparel Manufact.	16	0.33	0.19	1.06	14	0.30	0.21	0.88
25	Furniture & Fixtures	4	2.97	0.78	10.00	4	0.59	0.40	1.50
26	Printing & Publishing	4	0.48	0.37	1.00	3	0.47	0.52	0.65
27	Rubber & Plastic Products	34	0.98	0.19	4.90	34	0.80	0.25	2.86
28	Leather/Products								
29	Fabricated Metal Products, Jewelry	60	4.20	0.36	9.77	58	2.17	0.21	10.50
30	Ind. & Comm. & Transport Equip.	88	0.58	0.20	2.55	85	0.39	0.14	1.40
31	Electronic Equip. & Instruments	51	0.16	0.09	0.53	48	0.15	0.09	0.47

*NURP and USGS results were reported only as composite samples, not grab.
NR = Not Reported

APPENDIX G

GEOGRAPHIC ANALYSIS OF SIC CODES

APPENDIX G: GEOGRAPHIC ANALYSIS OF SIC CODES

			PERCENT OF FACILITIES LOCATED IN PART OF COUNTY ASSOCIATED WITH ...														
			%	Organized by "Urbanized Area" percent (cum.)					Organized by "Places" percent (cum.)				Coastal Areas percent		Growing Areas percent	
SIC	SIC NAME	COUNT	Phs I	Phs I+UAs	All UAs	UA>250	UA>100	UA>50	Inc>50k	Inc>25k	Inc>10k	Inc>5k	UAs	All	UAs	All
	ALL FACILITIES	7,736,471	32	45	61	49	57	61	45	61	79	88	37	48	18	25
	AG & SILVICULTURE CAT	310,086	14	20	31	21	26	31	23	36	57	72	16	28	10	17
	MANUFACTURING CAT	1,554,013	30	44	61	49	56	61	45	61	80	89	37	49	18	25
	COMMERCIAL/RETAIL CAT	5,872,372	33	46	63	51	59	63	47	63	80	89	38	49	19	25
	ALL POTENTIAL PHASE II	1,015,239	28	40	56	44	51	56	41	57	76	86	32	44	16	23
	PHASE II GROUP B "SECTORS"															
	Automotive Service	369,870	27	38	55	43	50	55	41	57	77	87	32	44	16	22
	Transport, Rail and other	14,808	47	64	81	72	78	81	57	72	87	94	57	63	23	27
	Petrol. Pipelines & Distributors	35,319	16	25	39	27	34	39	30	45	66	79	23	37	8	15
	Various Utilities	22,242	24	36	53	40	48	53	39	55	75	86	30	42	16	23
	National Security	2,414	34	43	60	45	53	60	44	62	81	90	36	48	16	23
	Munic. Services, Vehicle Maint.	4,611	25	35	51	38	46	51	39	55	76	86	30	46	13	21
	Wholesale, Wood Products	48,593	26	36	53	39	47	53	39	55	76	86	30	43	15	22
	Wholesale, Coal & Ores	1,384	23	31	48	35	45	48	38	57	79	87	18	23	7	12
	Wholesale, Metal Products	14,303	36	54	75	65	72	75	54	69	85	93	45	53	19	23
	Wholesale, Machinery	77,562	32	47	65	53	61	65	47	62	80	89	35	45	16	20
	Livestock, Feedlots	43,421	8	11	20	11	15	20	16	29	53	69	8	21	6	13
	Intensive Ag. Chemical Use	121,861	26	38	54	41	49	54	39	54	74	85	31	44	18	25
	Extensive Ag. Chemical Use	18,992	31	42	62	47	56	62	47	64	81	90	34	46	17	23
	Wholesale, Food	11,372	36	49	67	56	63	67	48	64	82	90	50	67	19	25
	Photographic Activities	30,684	40	53	70	57	65	70	52	68	84	91	42	51	23	29
	Machinery & Electrical Repair	135,744	29	40	56	43	51	56	42	58	77	87	32	44	18	25
	Laboratories	10,683	38	56	74	60	69	74	53	69	85	93	45	55	26	31
	Laundries	51,376	38	52	71	59	67	71	52	67	84	92	44	53	21	26
	General Farms	8,240	5	8	13	7	10	13	10	19	43	61	3	9	4	11

APPENDIX G: GEOGRAPHIC ANALYSIS OF SIC CODES (CONTINUED)

			PERCENT OF FACILITIES LOCATED IN PART OF COUNTY ASSOCIATED WITH ...														
			%	Organized by "Urbanized Area" percent (cum.)					Organized by "Places" percent (cum.)				Coastal Areas percent		Growing Areas percent	
SIC	SIC NAME	COUNT	Phs I	Phs I+UAs	All UAs	UA>250	UA>100	UA>50	Inc>50k	Inc>25k	Inc>10k	Inc>5k	UAs	All	UAs	All
	SELECTED (90) 4-DIGIT CODES															
0181	Ornamental Nurseries	11,019	24	33	49	35	43	49	35	53	75	86	30	49	19	29
0211	Beef Cattle Feedlots	2,972	7	9	17	9	12	17	13	22	42	59	3	8	5	10
0212	Beef Cattle, not Feedlots	14,684	7	9	15	8	11	15	11	20	43	61	4	11	5	13
0213	Hogs	4,328	3	6	12	5	8	12	10	22	43	63	4	16	2	5
0214	Sheep and Goats	618	6	8	16	8	12	16	12	24	42	58	4	11	6	16
0219	Gen'l Livestock, not Dairy	1,160	5	7	12	6	9	12	9	17	39	58	3	8	3	8
0241	Dairy Farms	12,298	6	8	19	9	13	19	17	36	62	76	8	29	5	13
0251	Broiler, Fryer, Roaster Chicken	941	4	6	15	7	9	15	13	32	60	78	7	25	4	17
0252	Chicken Eggs	1,171	9	12	26	12	20	26	23	42	67	80	14	36	8	16
0254	Poultry Hatcheries	719	7	10	20	9	15	20	17	35	62	78	9	25	4	13
0273	Animal Aquaculture	595	17	18	25	17	21	25	18	30	59	77	17	33	15	27
0291	General Farms	8,240	5	8	13	7	10	13	10	19	43	61	3	9	4	11
0782	Lawn & Garden Services	36,369	34	52	70	56	65	69	49	65	83	91	42	55	25	33
0783	Shrub & Tree Services	7,260	27	42	60	46	55	60	43	60	79	89	35	49	18	25
4612	Crude Petroleum Pipelines	390	21	26	41	29	36	41	30	44	64	78	13	20	7	9
4613	Refined Petroleum Pipelines	347	24	34	49	36	43	49	37	51	73	84	22	32	12	16
4619	Pipelines, NEC	18	17	39	78	61	72	78	50	67	89	94	44	44	22	22
4731	Arrange. Freight Trans	12,303	49	66	82	74	80	82	58	73	88	94	59	65	24	27
4741	Rental of Railroad Cars	175	33	46	75	62	70	75	53	68	85	93	38	45	21	27
4783	Packing and Crating	1,099	39	60	79	68	75	79	55	70	87	94	52	60	23	29
4785	Weighing: Vehicle Trans.	332	40	60	77	66	74	77	55	69	85	92	58	69	20	26
4789	Transport Services, NEC	899	32	45	63	52	59	63	47	62	81	89	35	44	17	22
4925	Gas Producers, Distributors	604	11	18	28	19	24	28	21	34	58	74	12	22	7	11
4932	Gas & Services	212	25	34	49	36	43	49	36	52	73	84	24	31	11	14
4939	Utilities, NEC	297	20	25	41	27	35	41	28	43	63	75	24	34	14	22

APPENDIX G: GEOGRAPHIC ANALYSIS OF SIC CODES (CONTINUED)

			PERCENT OF FACILITIES LOCATED IN PART OF COUNTY ASSOCIATED WITH ...														
			%	Organized by "Urbanized Area" percent (cum.)					Organized by "Places" percent (cum.)				Coastal Areas percent		Growing Areas percent	
SIC	SIC NAME	COUNT	Phs I	Phs I+UAs	All UAs	UA>250	UA>100	UA>50	Inc>50k	Inc>25k	Inc>10k	Inc>5k	UAs	All	UAs	All
4941	Water Supply	4,904	19	26	41	28	35	41	30	47	71	83	20	33	16	28
4953	Refuse Systems	10,797	26	40	58	45	53	58	43	59	79	88	36	49	15	21
4959	Sanitary Services, NEC	1,894	30	48	68	55	64	68	50	65	82	91	41	54	21	28
4971	Irrigation System	662	17	22	36	22	28	36	27	40	59	76	10	15	19	32
5031	Lumber, Millwork	13,836	37	50	67	54	62	67	49	66	83	91	38	48	20	27
5039	Consruct Materials	4,036	37	50	68	55	63	68	50	65	82	90	35	45	21	27
5051	Metal Service Centers	10,267	35	56	78	69	76	78	56	71	87	93	49	57	18	22
5052	Coal/Minerals & Ores Wholesale	1,384	23	31	48	35	45	48	38	57	79	87	18	23	7	12
5082	Constr. & Min. Mach.	7,143	34	46	62	48	57	62	46	63	81	90	30	40	17	23
5083	Farm Mach. & Equip.	13,670	11	15	24	15	19	24	18	32	55	71	9	20	7	12
5084	Industrial Mach. & Equip.	38,880	37	55	75	63	71	75	54	69	86	93	42	50	18	22
5085	Industrial Supplies	17,869	36	55	75	62	71	75	54	70	86	93	44	53	18	22
5144	Poultry & Products	1,495	27	37	53	41	48	53	41	58	77	87	32	43	12	19
5146	Fish & Seafoods	4,579	39	50	66	54	62	66	46	62	81	90	58	87	23	31
5147	Meat & Products	5,298	37	53	71	62	67	71	52	67	84	91	48	57	17	22
5154	Livestock	4,351	9	12	22	10	16	22	17	29	51	68	5	12	6	12
5159	Farm Products Raw Mats.	1,895	28	36	47	35	41	47	40	52	74	85	26	39	9	15
5169	Chemical & Allied Prod., NEC	10,355	37	56	74	63	70	74	52	68	85	92	43	52	19	24
5171	Petroleum, Bulk	8,086	9	12	22	12	17	22	16	29	53	70	8	19	5	10
5172	Petroleum Products/Dist.	11,128	22	31	45	33	40	45	34	49	69	82	23	36	12	17
5191	Farm Supplies	20,189	10	14	23	14	19	23	18	31	54	71	9	20	7	12
5211	Lumber & Build. Materials	34,757	21	31	47	34	41	47	35	51	73	84	27	41	13	21
5261	Lawn & Garden Supply	19,443	20	29	44	32	39	44	33	51	73	84	25	41	14	22
5511	Car Dealers, New & Used	37,387	22	32	49	36	44	49	36	54	75	85	28	41	13	20
5521	Car Dealers, Used Only	32,145	26	34	51	37	45	51	39	57	78	88	26	38	15	21
5541	Gas/Service Stations	91,924	23	34	49	38	44	49	35	51	72	84	29	42	13	19

APPENDIX G: GEOGRAPHIC ANALYSIS OF SIC CODES (CONTINUED)

			PERCENT OF FACILITIES LOCATED IN PART OF COUNTY ASSOCIATED WITH ...														
			%	Organized by "Urbanized Area" percent (cum.)					Organized by "Places" percent (cum.)				Coastal Areas percent		Growing Areas percent	
SIC	SIC NAME	COUNT	Phs I	Phs I+UAs	All UAs	UA>250	UA>100	UA>50	Inc>50k	Inc>25k	Inc>10k	Inc>5k	UAs	All	UAs	All
5983	Fuel Oil Dealers	7,233	16	36	58	45	54	58	46	63	80	89	50	71	8	13
5984	Fuel and Coal Dealers	6,226	11	15	26	16	21	26	20	35	60	75	12	28	8	17
5989	Fuel Oil Dealers, NEC	1,075	17	24	39	27	34	39	34	52	73	84	19	34	10	20
7211	Laundries	2,940	36	47	63	50	58	63	48	63	82	90	35	46	15	20
7212	Garment Cleaners	7,280	43	57	76	67	73	76	57	71	86	93	52	60	21	25
7216	Dry Cleaning	22,042	38	54	73	63	70	73	52	68	85	92	48	56	21	25
7217	Carpet Cleaners	13,636	34	47	66	51	60	66	48	64	82	91	35	46	23	30
7218	Ind. Launderers	903	33	48	66	51	60	66	50	66	84	92	37	45	16	21
7219	Laundry Services	4,575	40	55	74	62	70	74	55	70	86	93	45	53	22	26
7221	Photographic Studios	20,010	39	51	67	55	62	67	51	66	83	91	38	47	22	28
7342	Disinfect/Exterminating	12,359	36	48	63	50	58	63	46	63	82	91	35	46	22	29
7384	Photo Finishing Labs	10,674	43	58	74	62	70	74	55	70	86	93	49	58	26	32
7513	Truck Rental	7,799	30	45	64	50	58	64	47	64	82	91	36	46	15	20
7514	Passenger Car Rental	7,939	38	54	74	59	68	74	53	69	85	93	46	57	22	29
7521	Parking Structures	3,088	58	72	90	82	88	90	74	83	92	96	64	69	13	16
7532	Top, Body Repair	48,800	26	39	56	43	51	56	41	57	77	87	33	45	16	21
7538	General Auto. Repair	87,994	30	41	56	45	52	56	42	58	77	87	34	45	19	26
7539	Specialized Repair	26,381	31	43	60	47	54	60	45	61	80	89	32	43	19	25
7542	Car Washes	12,842	28	43	62	47	56	62	46	62	80	89	32	42	16	21
7549	Misc. Automotive Services	13,571	34	49	68	56	63	68	48	65	83	91	40	51	21	27
7622	Radio and Television Repair	20,527	28	39	56	43	51	56	41	58	77	87	32	44	16	22
7623	Refrig. & Air Condition Repair	8,504	33	43	59	47	54	59	44	59	79	88	33	46	18	25
7629	Electrical Repair Shops, NEC	19,448	31	43	60	47	55	60	44	61	79	89	34	46	19	25
7692	Welding Repair	14,305	18	26	40	28	35	40	30	46	67	80	22	36	12	19
7694	Armature Rewinding Shops	2,865	23	32	49	35	43	49	37	54	76	87	26	39	12	18
7699	Repair Shops & Related Serv, NEC	70,095	31	42	58	45	53	58	43	59	78	88	34	46	19	26

APPENDIX G: GEOGRAPHIC ANALYSIS OF SIC CODES (CONTINUED)

			PERCENT OF FACILITIES LOCATED IN PART OF COUNTY ASSOCIATED WITH ...														
			%	Organized by "Urbanized Area" percent (cum.)					Organized by "Places" percent (cum.)				Coastal Areas percent		Growing Areas percent	
SIC	SIC NAME	COUNT	Phs I	Phs I+UAs	All UAs	UA>250	UA>100	UA>50	Inc>50k	Inc>25k	Inc>10k	Inc>5k	UAs	All	UAs	All
7948	Race Tracks/Stables	2,271	27	42	59	45	53	59	44	61	80	89	34	47	18	26
7992	Golf Courses, Public	4,295	18	28	46	31	40	46	35	54	75	85	25	45	14	21
7996	Amusement Parks	1,371	23	32	51	36	45	51	38	56	78	87	26	42	13	22
8221	Colleges and Universities	6,829	35	47	69	51	62	69	53	70	85	92	38	46	16	21
8222	Junior Colleges	1,850	27	37	54	41	49	54	40	57	77	87	31	44	14	22
8249	Vocational Schools	4,647	41	54	71	60	67	71	53	68	85	92	41	50	22	28
8422	Botanical Gardens & Zoos	285	41	55	71	56	67	72	53	68	83	91	42	56	21	27
8731	Comm. Research Labs.	6,382	39	58	75	62	71	75	53	70	86	93	48	58	27	34
8734	Testing Laboratories	4,301	37	53	72	58	67	72	52	68	85	92	41	50	23	28
9221	Police Protection	2,508	21	33	50	37	44	50	36	53	74	85	31	47	12	20
9223	Jails	1,714	29	37	52	37	46	52	40	57	78	88	28	44	14	23
9229	Fire Protection	389	34	45	62	46	55	62	47	63	81	90	32	43	15	22
9511	Air, H_2O & Solid Waste Mgmt.	3,688	24	34	50	38	45	50	38	54	73	85	23	36	14	21
9711	National Security	2,414	34	43	60	45	53	60	44	62	81	90	36	48	16	23
	ALL TWO-DIGIT CODES															
01	Ag. Product-Crops	148681	7	10	17	9	13	17	13	24	45	64	7	18	5	10
02	Ag. Product.-Livestock	53788	7	10	18	9	14	18	15	27	51	68	6	18	5	13
07	Ag. Services	100857	29	42	58	45	53	58	42	58	77	87	33	46	21	29
08	Forestry	4167	15	19	28	16	23	28	22	40	66	81	15	40	9	20
09	Fishing, Hunting	2593	19	25	42	25	36	42	30	47	70	82	36	78	17	30
10	Metal Mining	1762	35	41	49	37	45	49	37	51	65	78	12	18	28	45
12	Coal & Lignite Mining	5684	8	9	18	11	15	18	20	45	72	81	3	5	4	8
13	Oil & Gas Extraction	27254	26	33	44	33	40	44	36	49	69	81	11	18	7	10
14	Nonmetalic Minerals	5236	15	23	34	24	30	34	26	42	66	80	15	30	11	20
15	Building Contractors	292337	30	44	61	48	56	61	44	61	80	89	36	50	20	28
16	Heavy Const. Contractors	41258	26	36	51	39	46	51	37	54	75	86	29	43	18	27

APPENDIX G: GEOGRAPHIC ANALYSIS OF SIC CODES (CONTINUED)

			PERCENT OF FACILITIES LOCATED IN PART OF COUNTY ASSOCIATED WITH ...														
			%	Organized by "Urbanized Area" percent (cum.)					Organized by "Places" percent (cum.)				Coastal Areas percent		Growing Areas percent	
SIC	SIC NAME	COUNT	Phs I	Phs I+UAs	All UAs	UA>250	UA>100	UA>50	Inc>50k	Inc>25k	Inc>10k	Inc>5k	UAs	All	UAs	All
17	Spec. Trade Contractors	471505	29	43	61	48	56	61	44	61	79	89	36	49	19	26
20	Man. Food, etc.	28791	29	39	56	43	50	56	42	58	77	87	33	45	16	22
21	Man. Tobacco	267	47	55	74	56	68	74	59	72	87	93	44	53	19	22
22	Man. Textile	11592	32	45	60	48	55	60	47	67	84	91	40	49	12	20
23	Man. Apparel	27667	50	63	75	67	72	75	58	72	86	93	57	65	21	26
24	Lumber & Wood	42363	18	24	35	25	30	35	27	44	70	83	20	41	12	20
25	Furniture & Fixtures	16127	39	51	67	55	62	67	50	66	84	92	43	52	24	30
26	Paper & Allied Prod.	8656	32	50	71	59	66	71	51	67	85	93	44	55	15	19
27	Printing & Publish.	93128	40	55	72	61	68	72	54	68	84	92	46	54	21	26
28	Chemicals & Allied	19980	35	54	72	61	68	72	51	67	84	92	46	55	20	24
29	Petroleum & Coal	3453	30	44	61	50	57	61	44	60	80	89	34	44	17	21
30	Rubber & Plastic Pds.	16910	29	47	67	55	63	67	49	66	84	92	43	55	18	23
31	Leather/Products	3398	35	47	62	52	58	62	49	63	80	89	43	53	15	20
32	Stone, Clay & Glass	21388	27	37	53	41	48	53	40	56	76	87	30	41	17	24
33	Primary Metal Ind.	10560	27	44	67	55	62	67	49	66	83	91	43	54	15	19
34	Fab. Metal Pds.	42861	31	49	69	58	65	69	51	67	84	92	44	55	18	23
35	Machinery - electric	73472	29	47	66	54	62	66	49	65	83	91	42	53	19	24
36	Electronic Equip.	24834	38	57	75	64	72	75	54	70	86	93	49	57	26	32
37	Transportation Equip.	16339	36	48	64	52	59	64	48	64	82	90	43	57	26	32
38	Instrument & Related	17129	37	58	77	66	73	77	55	71	87	94	50	59	25	31
39	Misc. Manufacturing	32916	39	53	72	61	68	72	54	69	85	92	47	57	22	28
40	Railroad Transport	3113	20	28	47	35	42	47	34	50	71	82	21	31	9	13
41	Local Pass. Transit	21908	31	48	65	54	61	65	48	64	81	90	48	59	13	18
42	Trucking	145846	26	38	55	43	50	55	40	56	76	87	32	43	14	20
43	U.S. Postal Service	1669	18	29	54	38	48	54	40	57	74	85	32	46	14	25
44	Water Transport	10769	33	44	59	47	55	59	40	57	77	87	49	76	19	28
45	Air Transport	13841	36	47	63	50	58	63	46	62	79	88	35	47	19	27

APPENDIX G: GEOGRAPHIC ANALYSIS OF SIC CODES (CONTINUED)

			PERCENT OF FACILITIES LOCATED IN PART OF COUNTY ASSOCIATED WITH ...														
			%	Organized by "Urbanized Area" percent (cum.)					Organized by "Places" percent (cum.)				Coastal Areas percent		Growing Areas percent	
SIC	SIC NAME	COUNT	Phs I	Phs I+UAs	All UAs	UA>250	UA>100	UA>50	Inc>50k	Inc>25k	Inc>10k	Inc>5k	UAs	All	UAs	All
46	Pipe Lines-Nat. Gas	755	22	30	46	33	40	46	34	48	69	81	17	26	10	13
47	Transport Services	44141	46	62	79	70	76	79	57	72	87	94	57	64	25	30
48	Communication	33732	29	39	55	42	50	55	41	57	76	87	30	41	16	23
49	Electric, Gas & Sani.	31120	21	31	47	35	42	47	34	51	71	83	26	38	13	21
50	Wholesale-Durables	369442	39	54	71	60	68	71	52	67	84	92	42	51	21	26
51	Wholesale-Nondurables	213239	36	49	64	54	60	64	47	61	78	88	41	50	18	22
52	Building & Garden Materials	103721	22	31	47	35	42	47	35	52	73	84	27	42	14	21
53	General Stores	48496	22	30	44	33	39	44	34	50	72	84	26	41	11	18
54	Food Stores	218896	28	39	55	43	50	55	41	57	77	87	35	48	14	21
55	Auto Deals & Service	234029	25	34	50	38	45	50	37	54	75	86	29	41	15	21
56	Apparel Stores	160303	38	51	67	55	62	67	50	65	82	91	44	54	21	27
57	Furniture Stores	170139	32	43	60	47	55	60	44	61	80	89	36	47	19	26
58	Eat & Drink Places	381020	33	45	63	51	58	63	47	62	80	89	39	50	18	24
59	Misc. Retail	533517	32	44	60	48	55	60	45	61	79	88	35	47	18	25
60	Banking	90152	30	43	60	48	55	60	44	60	78	88	38	50	16	22
61	Credit Agencies	34685	44	57	74	62	70	74	54	70	86	93	44	52	26	32
62	Security Brokers	30301	49	63	81	71	77	81	62	75	88	94	54	60	21	25
63	Insurance Carriers	13634	44	58	76	63	72	76	57	73	87	94	40	48	21	26
64	Insurance Agents	141608	32	45	63	50	58	63	46	62	80	89	35	45	18	23
65	Real Estate	333354	38	53	70	57	65	70	51	67	84	91	42	53	22	29
67	Investment Offices	28959	46	63	79	70	76	79	59	73	87	94	49	56	24	28
70	Hotels & Lodging	70760	23	29	43	30	38	43	33	49	71	83	25	44	17	30
72	Personal Services	291063	31	43	61	49	56	61	45	61	79	89	37	47	18	23
73	Business Services	386364	42	58	76	64	72	76	55	71	86	93	46	55	24	30
75	Auto Repair Services	228471	30	43	60	47	55	60	44	61	79	88	35	46	18	24
76	Misc. Repair	155412	29	40	56	44	51	56	42	58	77	87	32	44	18	24
78	Motion Pictures	38445	44	57	72	63	69	72	55	69	85	92	50	58	27	32

APPENDIX G: GEOGRAPHIC ANALYSIS OF SIC CODES (CONTINUED)

			PERCENT OF FACILITIES LOCATED IN PART OF COUNTY ASSOCIATED WITH ...														
			%	Organized by "Urbanized Area" percent (cum.)					Organized by "Places" percent (cum.)				Coastal Areas percent		Growing Areas percent	
SIC	SIC NAME	COUNT	Phs I	Phs I+UAs	All UAs	UA>250	UA>100	UA>50	Inc>50k	Inc>25k	Inc>10k	Inc>5k	UAs	All	UAs	All
79	Amusement Services	88067	30	42	61	47	55	61	45	61	79	88	37	49	18	25
80	Health Services	386373	35	50	68	56	64	68	50	66	83	91	43	53	20	26
81	Legal Services	127352	38	53	70	59	66	70	52	68	84	92	47	57	18	23
82	Educational Services	181729	24	36	52	40	47	52	39	54	74	84	31	44	13	19
83	Social Services	127245	32	43	61	47	56	61	46	63	81	89	36	48	17	23
84	Museums	5315	35	45	62	49	57	62	48	63	80	88	40	51	17	25
86	Membership Organizations	235386	30	40	59	45	53	59	44	60	79	89	33	44	15	20
87	Research & Development	253149	43	59	76	65	73	76	55	71	86	93	49	58	25	31
88	Households with Employees	645	23	29	45	33	40	45	33	49	71	82	28	41	17	23
89	Services, NEC	9974	45	60	76	65	72	76	58	72	87	93	48	57	24	31
91	Executive, Gen'l Govt.	26273	15	23	37	26	32	37	27	42	64	77	19	33	8	16
92	Justice, Public Order	16450	20	29	46	33	41	46	35	52	73	85	26	43	12	21
93	Public Finance, Taxes	1477	36	46	65	51	60	65	52	67	84	91	36	48	13	18
94	Human Resource Admin.	7853	23	32	48	35	42	47	38	53	72	83	26	38	9	15
95	Env. Quality & Housing Admin.	10344	22	31	47	35	42	47	35	51	72	84	25	38	12	19
96	Econ. Prog. Admin.	5692	30	39	54	41	49	54	41	57	76	86	28	40	13	20
97	National Security	3290	47	55	69	58	64	69	55	70	85	92	49	58	15	21

APPENDIX H

EPA REQUEST FOR COMMENT ON ALTERNATIVE APPROACHES FOR PHASE II STORM WATER PROGRAM

federal register

Wednesday
September 9. 1992

Part IV

Environmental Protection Agency

40 CFR Part 122

National Pollutant Discharge Elimination System, Request for Comment on Alternative Approaches for Phase II Storm Water Program

Recycled/Recyclable
Printed on paper that contains at least 50% recycled fiber

ENVIRONMENTAL PROTECTION AGENCY

40 CFR Part 122

[FRL-4202-9]

National Pollutant Discharge Elimination System, Request for Comment on Alternative Approaches for Phase II Storm Water Program

AGENCY: Environmental Protection Agency.

ACTION: Request for comment.

SUMMARY: In a memorandum dated January 28, 1992, the President asked regulatory agencies to review existing and proposed rules to improve cost effectiveness, minimize economic impact, and reduce regulatory burden. In response, today's notice requests information and public input on Phase II of the national storm water program mandated under section 402(p)(6) of the Clean Water Act (CWA). More specifically, EPA is today requesting public comment on a number of issues including scope of coverage under Phase II, identification of high risk Phase II discharges, alternative control strategies, and appropriate deadlines. With respect to each of these issues, the Agency is requesting input on how to meet environmental objectives and requirements set forth under section 402(p)(6) while at the same time identifying cost-effective control strategies that minimize the economic impact on the regulated community as well as the administrative burden on Federal, State and local government.

DATES: Comments on this notice must be received on or before November 9, 1992.

ADDRESSES: Respondents should send an original and two copies of their comments to Michael Plehn, Office of Wastewater Enforcement and Compliance (EN-336), United States Environmental Protection Agency, 401 M Street, SW., Washington, DC, 20460, (202) 260-6929. The public record for this notice is located at EPA Headquarters, NE Mall room 220, 401 M Street, SW., Washington, DC, 20460. Appointments to view the record can be made by contacting Michael Plehn at the above address. A reasonable fee may be charged for copying. The public record for previous rulemaking activity related to Phase I of the storm water program is located at EPA Headquarters, EPA Public Information Reference Unit, room 2402, 401 M Street, SW., Washington, DC, 20460.

FOR FURTHER INFORMATION CONTACT: For further information on this notice, contact the NPDES Storm Water Hotline at (703) 821-4823, or Michael Plehn, Office of Wastewater Enforcement and Compliance (EN-336), United States Environmental Protection Agency, 401 M Street, SW., Washington, DC 20460, (202) 260-6929.

SUPPLEMENTARY INFORMATION:

I. Background

A. Environmental Impacts
B. Water Quality Act of 1987
C. Current (Phase I) Storm Water Permitting Program

II. Today's Notice

A. Purpose and Intent
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I. Background

The 1972 amendments to the Federal Water Pollution Control Act (FWPCA, later referred to as the Clean Water Act or CWA) prohibit the discharge of any pollutant to the navigable waters of the United States from a point source unless the discharge is authorized by a National Pollutant Discharge Elimination System (NPDES) permit. Efforts to improve water quality under the NPDES program have focused traditionally on reducing pollutants in discharges of industrial process wastewater and discharges from municipal sewage treatment plants. This program emphasis developed because many industrial and municipal sources were not controlled at that time and were easily identified as contributing to water quality impairment. Over time, as pollution control measures were implemented for these discharges and as data collection efforts have provided additional information, it has become evident that more diffuse sources of water pollution, such as agricultural and urban runoff, are important contributors to water quality problems and use impairment. Some diffuse sources of water pollution, such as agricultural runoff and irrigation return flows, are exempted statutorily from the NPDES program. Controls for other point source discharge of storm water runoff, however, are addressed in this notice.

A. Environmental Impacts

Several national assessments have been conducted to evaluate the impacts of diffuse sources of storm water runoff on receiving water quality. The "National Water Quality Inventory, 1990 Report to Congress" provides a general assessment of water quality based on biennial reports submitted by the States under section 305(b) of the CWA. In section 305(b) Reports, States indicate the fraction of the States' waters that have been assessed, the fraction of those assessed waters that are not supporting designated uses, and the sources of use impairment for those waters (e.g., diffuse sources, point sources, and natural sources). The Report indicates that roughly 30 to 40 percent of assessed rivers, lakes and estuaries are not supporting the uses for which they are designated. Based on information from 51 States and Territories that reported on sources of pollution, the Report indicates that storm water runoff from a number of diffuse sources, including agricultural areas, urban areas, construction sites, land disposal activities, and resource extraction activities, is the leading cause of water quality impairment cited by States. For those States reporting in each category, diffuse sources were cited as causing use impairments in the following magnitudes: For rivers and streams, 11 percent of impaired river miles are caused by separate storm sewers, 6 percent are caused by construction activities, and 14 percent are caused by resource extraction. For lakes, 28 percent of impaired lake acres are caused by separate storm sewers and 25 percent are caused by land disposal. For the Great Lakes' shoreline, 6 percent of impaired shoreline miles are caused by separate storm sewers, and 41 percent are caused by land disposal. For estuaries, 30 percent of impaired acres are caused by separate storm sewers. For coastal areas, 36 percent of impairments are caused by separate

storm sewers, and 37 percent are caused by land disposal.

In 1985, the States conducted a different study of diffuse pollution sources under the sponsorship of the Association of State and Interstate Water Pollution Control Administrators (ASIWPCA) and EPA. The study resulted in the report entitled "America's Clean Water—The States' Nonpoint Source Assessment, 1985." In that study, 38 States reported urban storm water runoff as a major cause of beneficial use impairment. In addition, 21 States reported construction site runoff as a major cause of use impairment.

Studies conducted by the National Oceanic and Atmospheric Administration (NOAA) indicate that urban storm water runoff is indeed a major pollutant source that adversely affects shellfish growing waters.[1] The NOAA studies concluded that urban runoff affects 39 percent of harvest-limited area on the East Coast, 59 percent in the Gulf of Mexico, and 52 percent on the West Coast.

B. Water Quality Act of 1987

In response to growing concerns with the environmental impact of storm water runoff, Congress addressed this issue as part of the Water Quality Act of 1987 (WQA) by adding section 402(p) to the CWA to require the establishment of a comprehensive two-phased approach for the control of storm water discharges. Section 402(p)(1) prohibits EPA or NPDES States from requiring permits for storm water discharges until October 1, 1992, except for 5 classes of storm water discharges specifically listed under section 402(p)(2) (see appendix A). These 5 classes of discharges make up Phase I of the existing national storm water program and include storm water discharges:

(A) Permitted before February 4, 1987;

(B) Associated with industrial activity;

(C) From a municipal separate storm sewer system serving a population of 250,000 or more;

(D) From a municipal separate storm sewer system serving a population of 100,000 or more, but less than 250,000;

(E) Which EPA or a NPDES State determines contributes to a violation of a water quality standard or is a significant contributor of pollutants to the waters of the United States.

Section 402(p)(3) confirms that, like all other point source discharges under the CWA, discharges of storm water associated with industrial activity must meet all applicable provisions of CWA sections 402 and 301, including technology-based requirements and any necessary water quality-based requirements. Permits for discharges from municipal separate storm sewer systems may be issued on a system- or jurisdiction-wide basis and must meet a new statutory standard requiring controls to reduce pollutant discharges to the maximum extent practicable (MEP).

Phase II of the storm water program covers all storm water discharges not addressed under the five Phase I classes described above. Under the current provisions of section 402(p), the existing statutory prohibition against permitting Phase II storm water discharges expires on October 1, 1992 (see appendix B).

Under CWA section 402(p)(5), EPA, in consultation with the States, is required to conduct two studies on Phase II storm water discharges for which permits cannot be required before October 1, 1992. The first study will identify those sources or classes of discharges that may be addressed in Phase II and determine the nature and extent of pollutants in such discharges. The second study is to establish procedures and methods to control Phase II storm water discharges to the extent necessary to mitigate impacts on water quality. These studies have not been completed.

Under section 402(p)(6), EPA, in consultation with State and local officials and based on the two studies, is required to issue regulations by October 1, 1992, which designate particular sources or classes of Phase II storm water discharges to be regulated to protect water quality and which establish a comprehensive program to regulate such designated sources. This program must establish priorities, requirements for State storm water management programs, and expeditious deadlines. The program may include performance standards, guidelines, guidance, and management practices and treatment requirements, as appropriate.

The approach mandated by section 402(p)(2) is fully consistent with the intent and requirements of Section 319 of the WQA of 1987. Section 319 was enacted to require States to prevent and control nonpoint source pollution.

Under section 319 States are required to submit Nonpoint Source Assessment Reports identifying State waters which, without additional control of nonpoint sources of pollution, cannot be expected to attain or maintain designated uses. States were also required to prepare and submit for EPA approval a statewide management program for controlling nonpoint source water pollution to navigable waters within the State and improving the quality of such waters to levels sufficient for attaining or maintaining applicable water quality standards or goals. Furthermore, the State program submittal was to identify specific best management practices and measures which the state proposes to implement, in the first four years after program submission, to reduce pollutant loadings from identified nonpoint sources to levels required to achieve the stated water quality objectives.

Although the State nonpoint source programs are not enforceable under Federal law, States were encouraged to adopt both regulatory and non-regulatory approaches under State and local law. Section 319(b)(2)(B) specifies that a combination of "non-regulatory or regulatory programs for enforcement, technical assistance, financial assistance, education, training, technology transfer, and demonstration projects" may be used, as necessary, to achieve implementation of the best management practices or measures identified in the section 319 submittal.

To date, all States have approved section 319 assessments and approved management programs. EPA has awarded approximately $38 million in FY90 funds, $51 million in FY91 funds, and is in the process of awarding $52.5 million in FY92 funds to assist States in implementing the section 319 programs. EPA expects that State nonpoint source management programs will be revised and refined periodically in response to re-evaluated priorities and new strategies and technologies.

Numerous States and local governments have implemented regulations and enforceable policies to control nonpoint source pollution. States such as Delaware and Florida as well as local governments such as the Lower Colorado River Authority are aggressively pursuing storm water management goals through numerical treatment standards for new development. Many States and local governments have enforceable erosion and sediment control regulations. On a broader scale, nonpoint source pollution is being addressed at the watershed level by programs such as those being implemented by the State of Wisconsin and the Puget Sound Water Quality Authority and the states which are parties to the International Agreement on the Great Lakes. A number of individual States and local communities have adopted legislation or regulations like Maryland's Critical Areas Bill which limits development and/or

[1] "The Quality of Shellfish Growing Waters on the East Coast of the United States," 1989; "The Quality of Shellfish Growing Waters in the Gulf of Mexico," 1988; and "The Quality of Shellfish Growing Waters on the West Coast of the United States," 1989.

requires special management practices in areas surrounding water resources of special concern. California has also recently created Storm water management districts to better address the control of nonpoint source pollution.

A further development in the area of Federally-mandated nonpoint source management occurred in 1990 with the enactment of section 6217 of the Coastal Zone Act Reauthorization Amendments (CZARA). Section 6217 provides that States with approved coastal zone management programs must develop and submit to EPA and NOAA for approval a coastal nonpoint pollution control program. Failure to submit an approvable program will result in the loss of Federal grants under both the Coastal Zone Management Act and section 319 of the CWA. State nonpoint pollution control programs must also include enforceable policies and mechanisms which ensure implementation of the management measures throughout the coastal management area. Management measures as defined in section 6217(g)(5) are: "Economically achievable measures for the control of the addition of pollutants from existing and new categories and classes of nonpoint sources of pollution, which reflect the greatest degree of pollutant reduction achievable through the application of the best available nonpoint pollution control practices, technologies, processes, siting criteria, operating methods, or other alternatives."

The section 6217(g) guidance was issued for public comment in May, 1991. Final guidance is expected by October, 1992. The technology-based approach used in the guidance provides State Officials flexibility to meet the management measures using best management practices identified in the guidance or other methods and strategies which achieve equivalent or higher levels of pollutant control. If the technology-based approach fails to achieve and maintain applicable water quality standards and protect designated uses, additional management measures are required under CZARA section 6217(b)(3). Congress mandated a technology-based approach founded on technical and economic achievability under the rationale that neither States nor EPA have the money, time, or other resources to create and implement a program which depends on establishing cause and effect linkages between particular land use activities and specific water quality problems. Nonpoint sources addressed in the proposed guidance include: urban runoff from both developing and developed areas, roads, highways and bridges, agriculture, forestry, marinas, hydromodification, dams and levees.

C. Current (Phase I) Storm Water Permitting Program

EPA promulgated permit application regulations for Phase I storm water discharges on November 16, 1990 (55 FR 47990). The November 16, 1990 regulations established the scope of the Phase I storm water program by defining two major classes of storm water discharges identified under section 402(p)(2)(B), (C), and (D) of the CWA: Storm water discharges associated with industrial activity;[2] and discharges from municipal separate storm sewer systems (MS4s) serving a population of 100,000 or more.[3] In addition, the November 16, 1990 regulations established permit application requirements, including deadlines for these two classes of discharges (for a summary of Phase I see appendix A).

The November 16, 1990 regulations defined municipal separate storm sewer system serving a population of 100,000 or more to include municipal separate storm sewers within the boundaries of 173 incorporated cities, and within unincorporated portions of 47 counties that were identified as having populations of 100,000 or more in unincorporated, urbanized portions of the county.[4] In addition, the regulations allowed for additional municipal separate storm sewers to be designated by the Director of the NPDES program as being part of a large or medium MS4. The November 16, 1990 regulations establish comprehensive two part permit applications for discharges from large or medium MS4s. The permit application requirements for large and medium MS4s, among other things, require municipal applicants to propose municipal storm water management programs to control pollutants to the maximum extent practicable and to effectively prohibit non-storm water discharges to the MS4.[5]

The November 16, 1990 regulations also defined the term "storm water discharges associated with industrial activity" to include 11 categories of industrial facilities (see 40 CFR 122.26(b)(14)). The November 16, 1990 regulations establish two sets of application requirements for storm water discharges associated with industrial activity: Individual applications and group applications. In addition, the notice recognizes a third set of application procedures for storm water discharges associated with industrial activity referred to as "notice of intent" (NOI) requirements associated with general permits.

The Phase I storm water program takes two very different approaches to defining the roles of EPA and authorized NPDES States in controlling pollutants in storm water discharges. With respect to permits for large and medium MS4s, the efforts of the NPDES permitting authority (EPA or an authorized NPDES State) are directed to ensuring that municipalities develop and implement storm water management programs to control pollutants to the maximum extent practicable. Municipal programs address the control of pollutants in storm water from all areas within the boundaries of the MS4 that discharge to the system, including privately-owned lands, as well as modifying municipal activities (e.g. road deicing and maintenance, flood control efforts, maintenance of municipal lands, etc.) to address storm water quality concerns. The Agency has defined the role of municipalities under this program in a flexible manner that allows local governments to assist in defining priority pollutant sources within the municipality, and to develop and implement appropriate controls for such discharges. With respect to permits for storm water discharges associated with industrial activity, the NPDES permitting authority has a more direct role in regulating facilities.[6]

While today's request for comments focuses on developing Phase II of the storm water program, readers may find that a brief summary of progress to date

[2] On June 4, 1992 the United States Court of Appeals for the Ninth Circuit found that EPA's rational for exempting construction sites of less than five acres and certain uncontaminated storm water discharges from light industrial facilities from Phase I of the storm water program to be invalid and has remanded these exemptions for further proceedings (see *Natural Resources Defense Council* versus *EPA* No. 91-70176).

[3] Consistent with Section 402(p)(2) of the CWA, the November 16, 1990 regulations address two subclasses of municipal separate storm sewer systems serving a population of 100,000 or more. Large municipal separate storm sewer systems are defined as systems serving a population of 250,000 or more (see 40 CFR 122.26(b)(4)). Medium municipal separate storm sewer systems are defined as systems serving a population of 100,000 or more, but less than 250,000 (see 40 CFR 122.26(b)(7)).

[4] See appendices F, G, H, and I to 40 CFR part 122.

[5] See 40 CFR 122.26(d)(2)(iv).

[6] NPDES permits for discharges from large and medium MS4s will establish municipal responsibilities for assisting EPA and authorized NPDES States in implementing controls to reduce pollutants in storm water discharges associated with industrial activity which discharge through large and medium MS4s. A more detailed description of the role of municipalities in addressing industrial storm water sources under this Federal/State/Municipal partnership, is provided at 56 FR 40972 (August 16, 1991).

in implementing the first phase of the program would be helpful. Part of current implementation activities include outreach efforts and two rulemakings discussed in more detail below which are specifically designed to provide more flexibility and minimize regulatory and administrative burdens where possible.

As discussed above, the November 1990 storm water rule provided for three different options for storm water discharges associated with industrial activity to seek coverage under the program: individual, group, and general permit applications. Since November 1990, there has been a great deal of activity as EPA and the States have worked with the regulated community to provide guidance and implement the program. The Agency has established a four tier risk-based storm water permitting strategy which emphasizes the use of general permits (April 2, 1992, (57 FR 11394)). As part of the strategy, EPA called for the development of State storm water management programs to track permit issuance, provide for prioritization of risk, and create baselines against which to assess environmental results. As part of the same rule, the Agency extended the deadline for Part 2 of group applications until October 1, 1992, and also deferred regulation of storm water discharges from industrial activities owned or operated by municipalities with a population under 100,000 until Phase 2 of the program, pursuant to section 1068(c) of the Intermodal Surface Transportation Efficiency Act of 1991. In providing for greater flexibility, reduced burdens, extended deadlines, and deferred regulation, this recent storm water rulemaking addresses many of the goals underlying the President's January 28, 1992 request to review existing regulations.

Since November 1990, the Agency has received over 1,200 Part I group applications representing more than 60,000 facilities. EPA is currently processing these applications. Final decisions have been reached on over 1,000 to date. Approximately 75% have been approved, 20% withdrawn or determined not to be covered, and 5% denied. Part I group applications were due on September 30, 1991. Part II sampling information from approved groups is due on October 1, 1992.

At the same time that EPA has been receiving and processing group applications, States have been actively moving to provide for storm water general permit issuance. When the storm water application rules were issued in November 1990, only 17 out of 39 States authorized to administer the NPDES program were also approved to issue NPDES general permits. Since then, an additional 16 States have requested and received Federal approval to issue general permits. Over two thirds of the States that now have general permit authority are presently developing specific general permits to cover storm water discharges.

For the 12 States without NPDES authority, EPA is in the process of issuing storm water general permits that rely heavily upon industrial facilities developing and implementing their own storm water pollution prevention plans.

As part of the four tier risk-based permitting strategy referred to above and discussed in more detail in the Agency's April 2, 1992 notice, EPA believes that the majority of storm water discharges associated with industrial activities should be covered by general permits. The Agency urges all authorized NPDES States without general permit approval to obtain NPDES general permit authority.[7] EPA places a high priority on this effort and is providing direct technical guidance and assistance to support States both in obtaining general permit approval and in developing specific general storm water permits.

With regard to guidance, training, and outreach, EPA has undertaken a number of efforts to provide technical assistance and also to get public input on ways to streamline the existing program. In the area of guidance, EPA has published and distributed thousands of municipal and industrial permit application manuals in addition to numerous summaries, fact sheets and work shop materials over the past eighteen months. The Agency has issued additional guidance on storm water sampling, pollution prevention plan development, and storm water best management practices (BMPs), and is developing guidance for part 2 municipal applications. A list of EPA technical guidance, summaries, and storm water fact sheets can be obtained by calling the Agency's storm water hotline at (703) 821-4823.

In the area of training and outreach, EPA staff has participated in over 60 workshops and presentations throughout the country, training permitting authorities and educating the regulated community. For example, EPA Regions held fourteen public hearings to receive public comment on the Agency's proposed general permits in August and September of 1991. EPA held an additional 26 storm water workshops across the country this summer and would welcome hearing from groups or organizations interested in receiving workshop materials for further in-house or local training.

While EPA recognizes the importance of ongoing training and outreach efforts to provide information on the storm water program, the Agency also regards these activities as an effective mechanism for getting feedback on the program and identifying areas for further improvement. The new guidance documents referred to above and presently being developed reflect input from States and the regulated community on high priority areas requiring clarification and further technical assistance.

In addition to these activities, EPA has recently completed a study, in conjunction with the Rensselaerville Institute, to obtain direct public input and develop recommendations for streamlining the program and making it more effective. This study has two objectives. The first is to develop recommendations to streamline program implementation under existing regulations and legislation (Phase I). The second is to develop cost-effective options for addressing risks from storm water sources not currently required to be permitted that could potentially be addressed under Phase II of the storm water program.

Under the first objective, the Rensselaerville Institute sponsored 6 focus groups across the country with members representing state and local government, the regulated community, and environmental interests for uninterrupted full day discussions on ways to improve the storm water program. Five key issues were raised by all groups: (1) Groups felt that EPA has not been very clear about the intended goals of the regulations and should communicate storm water risks, objectives, and requirements more clearly to the general public as well as the regulated community, (2) participants noted that the cost of program implementation is significantly higher than original EPA estimates and there is great concern regarding the real costs of the program and of achieving compliance, (3) there was consensus that EPA and States must accelerate general permit issuance and focus on general permits to achieve efficient implementation of the program, (4) participants felt that technical outreach should be targeted at the State and local level as opposed to the national level and should provide better guidance on the regulations and how to implement

[7] Currently, DE, IA, KS, MI, NV, NY, OH, SC, VT and the Virgin Islands have authorized NPDES programs, but do not have general permit authority.

them, and (5) groups noted that coverage under certain industrial storm water categories should be clarified.[8] EPA agrees with these recommendations and is taking steps, some of which are outlined above, to follow up in each of these areas.

The second objective of the Rensselaerville study, consistent with the purpose of today's notice, is to get as much input as possible on different options for identifying and addressing those Phase II storm water discharges not regulated under the current program. Under the study, however, the mechanism for encouraging feedback was more targeted and interactive. The Rensselaerville Institute has obtained input from national experts (representing permitting authorities, the environmental community, and regulated interests) and then followed up with a series of 3 expert discussion forums that were open to the public in June.

The public meetings were held in Denver, San Francisco and Washington, DC. Attendees were divided into task teams and asked to develop their own strategy for addressing Phase II sources. There were 16 task teams: Five each at the Denver and San Francisco meetings, and six in Washington, DC. They were given a strategy template to guide them in their discussion, but were not confined to the template in developing their strategies and recommendations.

Each team considered and then presented the option they had developed over a four hour period. There were common strategy characteristics mentioned across groups within meetings and also across meetings. The recommendations of the focus groups covered four specific areas: Targeting strategies, controls that should be put in place, timetable, and the role of EPA in Phase II. The recommendations made by focus groups regarding the first three areas are discussed below along with the options presented for comment.

With regard to the role of EPA, participants identified the areas of responsibility they felt it would be appropriate for EPA to assume under Phase II. Their recommendations can be classified by four common themes: (1) Teams felt that EPA should provide technical assistance, information dissemination, and do any research necessary as a part of Phase II; (2) participants suggested that EPA should provide funding for research or demonstration projects, but not for program implementation; (3) groups stressed that EPA should set broad guidelines for the program, but allow State and local governments to determine the level of specificity needed to effectively implement the program; and (4) teams felt that EPA should be responsible for training regulators in the program.

II. Today's Notice

A. Purpose and Intent

CWA sections 402(p)(5) and (6) require EPA to identify storm water discharges not covered under Phase I which should be regulated to protect water quality.[9] The purpose of this notice is to solicit public comment on ways to implement the second phase of the storm water permitting program for sources and activities not regulated under the existing program. EPA is seeking comments on approaches for meeting CWA Phase II storm water requirements while at the same time minimizing the economic impacts and regulatory and administrative burdens associated with additional Phase II storm water controls. There are a number of ways to identify additional categories of storm water activities for further controls and EPA requests comment on the alternatives listed below as well as on any other approaches that may not be identified in today's notice.

B. Alternative Approaches

EPA is interested in comments from the general public, state and local government, the regulated community and environmental groups on each of the options outlined below. The goal of the CWA is to restore and maintain the chemical, physical, and biological integrity of the Nation's waters. In practice, programs implemented under the Clean Water Act have two basic goals: To reduce pollutant loadings to the environment and to require more stringent controls where necessary to assure attainment of State water quality standards and designated uses. These goals are compatible. However, the specific regulatory strategy and pollution reduction alternatives to be chosen for addressing Phase II storm water discharges could have a large impact on the size of the regulated universe and regulatory burden associated with the program.

To generate discussion and input from commenters, today's notice discusses several alternative approaches for controlling storm water discharges from currently unregulated sources under Phase II of the storm water program. A number of different control strategies, with variations in scope and timing, are outlined below. They range from comprehensive permitting of all municipal, light industrial, and commercial activities that generate storm water runoff to little or no NPDES permitting of Phase II sources.

A major distinction between several of the options listed below is whether Phase II efforts should focus on developing requirements for targeted municipalities to develop source controls and management programs for storm water discharges within their jurisdictions (for example, see options (b) and (c) below) or whether Phase II should, instead, focus on point source discharges of storm water without reference to the municipality in which they may be located. Under the first approach, EPA would develop NPDES requirements that required targeted municipalities to develop and implement storm water management programs which address storm water discharges within their jurisdiction [10] to the maximum extent practicable. This approach would allow for flexibility based on local factors, but could lead to varying levels of control from one area to another. EPA requests comments on the ability of municipalities to effectively regulate storm water discharges. In addition, the Agency requests comment on appropriate funding mechanisms for municipal programs, in particular the feasibility of implementing storm water utilities, which are currently being used in more than 100 communities nationwide.[11]

To facilitate comment and analysis, the following discussion is organized in terms of three issues: Targeting, control strategies, and deadlines. Each of these areas overlap and any final decision must reflect choices from each group. However, the objective is to solicit input

[8] The regulatory definition of storm water discharge associated with industrial activity identifies 11 categories of industrial facilities (see 40 CFR 122.26(b)(14)). In particular, category viii (certain transportation facilities) and category xi (certain manufacturing facilities with materials and/or materials handling equipment exposed to precipitation) were identified as needing clarification.

[9] Section 502(14) of the CWA excludes agricultural storm water runoff from the definition of point source. Section 402(1)(2) prohibits EPA from requiring an NPDES permit for certain "uncontaminated" storm water discharges from mining sites and oil and gas operations. EPA cannot regulate these discharges under section 402(p)(6) of the CWA.

[10] One issue that needs to be resolved is whether targeted municipalities should be responsible for controlling all priority storm water discharges within their jurisdiction or only those that discharge directly to the MS4.

[11] For more information see "Storm Water Utilities: Innovative Financing for Storm Water Management", EPA, Water Policy Branch, OPPE, 1992.

on three basic questions. First, what should be covered under Phase II; that is, what additional municipal separate storm sewer systems, municipal industrial activities, commercial, light industrial, retail, or residential activities not presently covered under Phase I of the storm water program should be targeted or identified as needing additional controls? Second, what control strategies should be developed and implemented to address these Phase II activities? Third, what deadlines or time frames should apply in implementing Phase II of the storm water program?

In addressing each of these questions, commenters are requested not only to provide their views on appropriate alternatives (including approaches that may not be included in this notice), but also where possible detailed rationales and additional data or other information which address the practical, administrative and legal feasibility and/or the environmental benefits, of a particular option. In addition, each of the approaches presented could be combined with others to achieve specific environmental objectives. For example, dischargers of specific pollutants in particular water bodies could be targeted for permits or more stringent controls. Along with input on individual options EPA requests comments on possible combinations or other approaches not outlined above. Commenters are also asked to address the roles and responsibilities of Federal, State and local governments under various approaches, particularly with respect to: (1) Identifying approaches that target MS4s in currently unregulated municipal areas as needing permits, and (2) approaches that identify classes of individual facilities (e.g. commercial or retail facilities) as needing permits.

The Agency also requests input on what type of information should be used in identifying sources to be covered and whether commenters believe there is presently sufficient information or monitoring data at the state and local level to expeditiously implement a particular option listed below. If on a national or regional basis there are not sufficient data, the next question to be addressed is whether a comprehensive monitoring and data gathering effort is warranted to assure effective implementation of one approach over another. In other words, there may be a trade off between: (1) Near term general targeting approaches combined with flexible control strategies based on information currently available, and (2) a heavier reliance on longer term specific geographic, watershed, or water body related targeting mechanisms which may require more comprehensive data gathering efforts on both a facility and stream reach basis.

1. Targeting

(a) Seek amendments to the CWA to eliminate Phase II and use designation authority to bring additional sources under Phase I. Section 402(p)(2)(E) presently provides that EPA or a State may designate non-industrial storm water discharges and discharges from MS4s other than those serving a population of 100,000 or more for control under Phase I where the discharge contributes to water quality violations or is a significant contributor of pollutants to waters of the U.S. Some commenters may conclude that the remaining unregulated discharges of storm water (associated with smaller municipalities, commercial activities, and some retail or residential activities) constitute, on the whole, a negligible source of environmental risks, relative to the discharges already regulated.

Under this option, Congress would amend the CWA to eliminate section 402(p)(6) (Phase II requirements) as a part of the NPDES program and expand use of the existing designation authority under 402(p)(2)(E) to designate individual or classes of storm water activities on a category, watershed, stream reach, loadings, or other basis for specific regulation under existing Phase I requirements. Under this option, those storm water activities not designated for Phase I controls could be addressed by an alternative means, possibly under the State nonpoint source management programs funded under section 319 of the CWA or coastal nonpoint pollution control programs developed pursuant to section 6217 of the CZARA. The Agency requests comments on: (1) Whether State programs funded under Section 319 can better ensure appropriate control of diffuse pollutant sources and; (2) whether heavier reliance on State nonpoint source programs to address Phase II storm water point source discharges would have adverse impacts on States' program resources and the ability of States to address agricultural sources. The selective nature of this designation option could reduce the potential economic impact on the economy and small entities. However, using 402(p)(2)(E) may be viewed by some commenters as a reactive approach which does not recognize the advantages of prevention of storm water pollution problems over remediation of these problems after they have been identified. This approach may also increase the administrative burden on States and local government to identify and undertake the necessary administrative process to include additional storm water activity under Phase I.

(b) Identify targeted MS4s as needing an NPDES permit under section 402(p)(6) of the CWA. The Phase I MS4 program currently only applies to municipal separate storm sewer systems serving a population of 100,000 or more. EPA has defined the scope of these Phase I requirements to specifically identify 173 incorporated cities with a population of 100,000 or more and 47 counties with a population of 100,000 or more in unincorporated, urbanized areas.[12] In general, this approach focuses on core cities of large metropolitan areas, but with the exceptions of 47 counties addressed, does not address urban fringes or suburban areas in large metropolitan areas, urbanized areas without large core cities, or smaller isolated cities or population centers.[13] EPA requests comments on factors that should be considered when evaluating options for addressing Phase II MS4s.[14]

[12] The 220 cities and counties addressed by these definitions have a combined population of over 87.5 million people under the 1990 Census. However, a significant percentage of the population of the 220 municipalities are served by combined sewers (not addressed by the storm water program), which are found primarily in areas of older development.

[13] The 1990 Census indicates that 87.3 million people lived in areas designated as urbanized areas but outside of incorporated cities with a population of 100,000 or more. Portions of over 5,400 incorporated cities, towns and villages, 900 counties and about 1,500 minor civil divisions (unincorporated towns and townships) are in Phase II municipalities that are part of urbanized areas.

[14] EPA outlined seven factors it considered when defining the scope of large and medium MS4s (see December 7, 1988 (53 FR 49444), and November 18, 1990 (55 FR 48038)). These factors included: the advantages of developing system-wide storm water management programs for municipal systems; the inter-jurisdictional complexities associated with municipal governments; the fact that many municipal storm water programs have traditionally focused on water quantity concerns, and have not evaluated water quality concerns; the geographic basis necessary for planning comprehensive management programs to reduce pollutants in discharges from MS4s; the geographic basis necessary to provide flexibility to target controls on areas where water quality impacts associated with discharges from MS4s are the greatest and to provide an opportunity to develop cost effective controls; the need to establish a reasonable number of permits; Congressional intent to allow the development of jurisdiction-wide, comprehensive storm water programs with priorities given to the most heavily populated areas of the country. The Agency requests comment on which of these factors should be considered in identifying Phase II MS4 sources.

The Agency also requests comment on the advantages of municipalities associated with urbanized areas coordinating storm water management efforts on a regional basis. The Agency notes that a number of municipalities have developed regional administrative approaches to flood control management.[15] Regional administrative approaches appear to provide opportunities for municipalities to lower overall administrative burdens, consolidate efforts to study or evaluate approaches, and adequately plan cost-effective approaches to consider and address the needs of all represented municipalities. The Agency requests input on how it could or should encourage the development and use of regional approaches to storm water management under the NPDES program. Specifically, EPA requests comments on the following targeting options as well as any that may not be included in this notice.

(i) *Focus on population.* Expand coverage to address additional municipalities based on population. Following the Phase I approach, coverage of municipalities could be expanded by lowering the minimum population requirement across the board or by designating additional municipalities or municipal systems by name. EPA requests comments on the appropriate role of county governments and appropriate ways to characterize the population of counties under this approach.[16] This approach controls more sources of storm water, but imposes regulatory burdens on additional municipal entities.

(ii) Focus on population density. Alternatively, EPA could focus on the population density of metropolitan areas instead of the population within a particular municipality or municipal system, and require permits for discharges from municipal separate storm sewers in areas of a specified density. Urban storm water runoff is related to the density of urban development, the increase in impervious areas, and the reduction in the area of recharge and infiltration zones. EPA requests comment on the use of urbanized areas designed by the Bureau of Census as a tool for characterizing population density and development patterns.[17]

(iii) Focus on population growth. Focussing on population growth in addition to, or in place of, population density might be an additional consideration in implementing this option.[18] Studies have shown that it is much more cost effective to develop measures to prevent or reduce pollutants in storm water during new development than it is to correct these problems later on.[19] In addition, appropriate storm water measures for new development can prevent or minimize irreversible degradation to surface waters. This approach might serve to minimize the impact of small and lightly-developed population centers, but it would still increase the burden on a number of municipalities not presently regulated under Phase I.

(c) *Continued reliance on Phase I MS4s to control Phase II sources which discharge through their system.* Under this approach, EPA would generally not designate additional individual sources (such as commercial and light industrial sources) which discharge through a large or medium MS4 as needing their own NPDES permit. Instead, EPA would continue to rely on municipalities to identify priority storm water discharges and develop appropriate controls for those discharges as part of requirements to develop and implement municipal storm water management programs. This option addresses some currently unregulated sources, allows for flexibility and consideration of local factors, and avoids duplicative regulation at the local, national and State level. This approach also relies on existing institutional frameworks of municipalities[20] as well as the institutional framework that EPA envisions municipalities will develop pursuant to NPDES requirements.[21] However, it imposes additional administrative and regulatory costs on local governments and may result in varying levels of control among municipal programs. The Agency requests comment on whether municipalities are in the best position (with assistance from EPA and authorized NPDES States through technical guidance) to identify priority sources which discharge through their MS4, or whether EPA should attempt to designate such additional sources as needing an NPDES permit. The Agency also requests comments on the appropriate funding mechanisms for MS4s (e.g. storm water utilities, various fees, general revenues, etc.), and opportunities for municipalities to modify existing functions to address storm water concerns.

(d) *Identify additional Phase II activities other than MS4s based on comparative loadings.* EPA could use available information (such as case studies and other research) to prioritize Phase II sources in terms of their relative pollutant loadings as well as the type and nature of those loadings. On this basis the Agency could issue regulations to target those general activities which contribute the highest loadings of pollutants to receiving waters as needing an NPDES permit. This option is consistent with the technology-based approach reflected in the existing CWA. It would provide more comprehensive coverage and clarify the program. It would also avoid expensive and time consuming debates regarding the specific causal relationship between a particular storm water discharge and site by site specific receiving water quality impact. However, it would impose further administrative and analytical burdens in terms of gathering additional loadings information on a national basis. This approach may also result in including

[15] For more information see: William A. Macaitis, "Regional Storm Water Management Trends", and: L. Scott Tucker, "Current Programs and Practices in Storm Water Management", Water and the City: the Next Century, Public Works Historical Society, 1991.

[16] The 1990 Census indicates that 447 counties have a population of 100,000 or more. The current definitions of large and medium MS4 address 47 of these counties not already covered by Phase I of the program.

[17] The Bureau of Census defines urbanized areas comprised of a central city (or cities) with a surrounding closely settled area. The population of the entire urbanized area must be greater than 50,000 people, and the closely settled area outside the city, the urban fringe, must have a population density generally greater than 1,000 persons per square mile (just over 1.5 persons per acre) to be included. The Bureau of Census defined 396 urbanized areas in the United States based on the 1990 Census. These urbanized areas have a combined population of 158.3 million, or 63.6 percent of the nation's total population. However, these areas only account for 1.5 to 2 percent of the land surface of the country.

[18] Most Urban growth occurs in urban fringe areas outside of large core cities. For example, between 1970 and 1980, the population in those parts of Census designated urbanized areas that are outside of incorporated cities with a population of 100,000 or more increased by 18.9 million. During this same time period, the population of incorporated cities with a population of 100,000 or more (Phase I cities) increased by only 0.6 million, with the population of many of these cities decreasing.

[19] For example, see "Results from the Nationwide Urban Runoff Program, Vol 1—Final Report", EPA, 1983.

[20] Examples of municipal functions that can be adapted to provide for consideration of storm water concerns include oversight of new development, fire safety inspections, pretreatment program implementation, flood control activities, management of municipal lands and activities, and maintenance of public roads.

[21] The NPDES regulatory framework for permits for large and medium MS4s envision that municipalities will be required to develop and implement storm water management programs to reduce pollutants in non-storm water discharges (e.g. illicit connections and improper dumping); storm water from residential and commercial areas; storm water discharges from industrial activities; and storm water discharges from construction activities.

more sources than necessary due to differences in loadings and existing storm water controls, both structural and non-structural, across similar activities. The regulatory burden would be determined in large part by the overall control strategy chosen to implement this approach.

This approach differs from those outlined under options (b) and (c) in that it relies on direct permitting by EPA and authorized NPDES States rather than requiring municipalities to develop programs to address sources. The Agency requests comments on which sources of pollutants are better addressed by specific NPDES permit requirements rather than through municipal storm water management programs required pursuant to NPDES permits for MS4s. For example, activities generally located in rural areas such as feedlots, orchards, and golf courses most likely are not suited for control through municipal storm water management programs required under permits for MS4s. Although large feedlots (those subject to effluent limitations guidelines) presently are covered under Phase I, smaller feedlots represent a significant source of pollutants such as suspended solids, BOD, and nutrients such as nitrates and phosphates. In addition, storm water discharges from commercial activities such as greenhouses, nurseries, and golf courses might be more effectively controlled under a separate NPDES permit requirement than through a MS4 program. As another example, many commenters from all levels of State and local government have expressed concern about municipalities being required to control pollutants from State highways (see November 16, 1990 (55 FR 48041)).

(e) Geographic targeting. EPA could regulate Phase II storm water activities on a watershed, waterbody, or regional basis to protect water quality, control water quality problems and attain designated uses in specific areas. EPA could:

(i) Designate additional municipal and individual sources for permitting in specific areas. A key aspect of this approach would be developing a list of waters that are not meeting designated uses due to pollution from storm water runoff (from section 305(b) reports or from the section 304(l) list of waters) or where sensitive waters or outstanding national resource waters need special protection. This approach could help to achieve water quality goals and would avoid imposing a burden on other dischargers, but would not be uniformly applied on a national basis. This option is also reactive in nature, and overlooks the advantages of prevention over remediation. The availability of technical information and water quality data limitations and the administrative and regulatory burden associated with collecting and analyzing additional data would have to be carefully considered in evaluating the feasibility of this approach.

(ii) Designate additional sources for permitting or special requirements within rainfall zones. The nature of storm water problems varies between areas with frequent rainfall, where storm water flows are high with continual pollutant loadings, and areas with low or seasonal rainfall, where intermittent flows carry highly concentrated loadings of pollutants accumulated during dry weather which result in high shock loadings to receiving waters. This option would recognize these regional variations and tailor regulatory requirements for Phase II discharges (monitoring, best management practices, reporting) to the local nature of rain events. However, immediate environmental benefits could be delayed due to the inexact nature of rainfall zones and the scarcity of comprehensive information upon which to base regulatory requirements.

(f) Establish requirements for State storm water management programs. Under this approach, EPA could develop requirements for State storm water management programs under section 402(p)(6) for the CWA which would require States to identify additional classes of storm water discharges for control. This approach may offer the advantages of additional flexibility for States to target sources based on State specific factors (climate, water resources, development patterns) and provide additional flexibility in the type of administrative program developed. However, the disadvantages of this approach include the need for generating additional resources at the State level at a time when State capacity is also strained, and possible disparities in programs in different States. Such disparities could make it hard for a State to develop an aggressive program when neighboring States have lesser requirements. Further, this approach may create additional burdens on EPA to provide adequate oversight of the State programs. EPA also requests comments on the appropriate role of EPA in reviewing State plans or developing minimum requirements for State plans and how that role should change, if at all, for States without authorized NPDES programs. The Agency requests comments on appropriate criteria for evaluating the adequacy of State programs, and appropriate procedures for periodic review and evaluation of such programs. EPA also requests comments on whether this approach could be harmonized with the requirements of section 402(p)(6) for EPA to take the lead in developing management practices and controls for Phase II sources, or whether this approach might also require statutory change.

(g) Rensselaerville focus groups. There were several common themes recognized by the focus groups with regard to identifying potential sources to be included in Phase II:

(i) Groups suggested that targeting be done on a watershed basis, with information gathered as a part of Phase I used to help identify sensitive watersheds. It was noted that this type of targeting approach may require intergovernmental agreements for effective implementation.

(ii) Teams emphasized that the focus of Phase II should be on "bad actors", i.e. those sources that are known to cause significant water quality problems. Sources identified by team members included: Gas/auto service industries, transportation, highway systems, land use development and agricultural sources. There was a consensus among groups that facilities not contributing to impairment of water quality should be able to gain an exemption from controls, permits, fees, and implementation of BMP's. Teams concluded that SIC categories are an ineffective way to designate covered sources and that targeting should be done based on the degree of risk that a given facility poses, due to possible differences between facilities in any one industry.

(iii) Focus groups recommended that small municipalities be included in Phase II but with simplified application requirements. Participants felt that municipalities impacting watersheds of concern or those connected to larger MS4s should be targeted.

(iv) Participants in the study felt that EPA should hold off on selecting sources for Phase II until the Agency has carefully looked at the date gathered during Phase I. It was noted that numerous sources of information are available which could help determine targeting priorities, for example, 305(b) reports, information from Phase I program sources, NURP, and the first Report to Congress.

2. Control Strategies

The current Phase I storm water program for industrial sources is implemented through the NPDES program with a heavy emphasis on the use of general NPDES permits which require the implementation of best management practices including development of site specific pollution prevention plans. Phase I requirements for large and medium MS4s focus on system-wide permits which require the development and implementation of municipal storm water management programs:

Regardless of how additional Phase II storm water activities are identified—whether they are designated under 402(p)(2)(E), comprehensively covered, or selectively targeted for further controls, a key issue on which EPA requests comment is what are the appropriate tools or control strategies to put in place which assure pollutant loading reductions and water quality improvement?

(a) Continued reliance on NPDES program. One option is the continued reliance on individual or general NPDES permits for individual sources, and system-wide permits for MS4s. Developing or processing specific application forms for and issuing individual permits for all Phase II sources may well be the most resource intensive of any control approach. Consistent with EPA's four tier Phase I permitting strategy for industrial storm water sources, individual permits may be most appropriate in those case specific situations where a particularly difficult or complex discharge situation needs to be addressed. By contrast, input from the public and regulated community to date suggests that heavy reliance on general permits may well be a very effective alternative within the NPDES system. EPA solicits comments on whether continued reliance on NPDES permitting as the overall control strategy for Phase II is the most appropriate approach. An extensive State and national administrative NPDES infrastructure already exists and is being relied upon for Phase I and reliance on the general permit is increasingly favored as an appropriate storm water control strategy. However, the capacity of the current system with its existing resources to accommodate a significant number of additional permittees has already been called into question for Phase I. A very real issue exists as to whether the permitting Agencies have the resources to address more than a limited number of additional Phase II permittees.

(b) Continued reliance on nonpoint source program. Another approach includes continued reliance on the State nonpoint source programs under section 319 of the CWA and future reliance on programs under section 6217 of the CZARA in coastal areas to control Phase II storm water sources not explicitly addressed or designated under Phase I.

The structure, organization, and working relationship within EPA and State offices for the section 319 program are established and proven successful. The States have taken the lead under section 319 to develop assessments of storm water/nonprofit source impacts and management programs to implement controls. EPA has approved all States assessments, 44 complete management programs, and portions of all the remaining State management programs. The States management programs typically include continued problem assessments and monitoring, voluntary control measures, mandatory control measures established under State and local authorities, State funding assistance, public outreach, technical assistance, enforcement, targeting of priority waters, and coordination with other Federal and State programs and agencies. Therefore, the section 319 program's potential ability to control Phase II sources is high. Also, section 319 programs are founded on a watershed planning and pollution prevention/source reduction approach which may be an effective vehicle to provide program and technical assistance to State and local governments.

In addition, the new CZARA program provides an excellent tool to address Phase II sources in the coastal zone in a comprehensive manner. EPA emphasizes that the goals of the NPDES and CZARA programs are complementary. Many of the techniques and practices used to control urban runoff are equally applicable to both programs. While different legal authorities and geographic coverage may apply to specific sources, States have the option to implement CZARA section 6217(g) management measures throughout the coastal zone, as long as NPDES requirements are met for those entities subject to NPDES requirements. States outside of the coastal zone may also voluntarily incorporate the management measures appropriate to particular sources or specific problems into the State's CWA section 319 program.

(c) Mandatory performance standards, guidelines, management practices and/or treatment requirements. An alternative option might also be to develop a set of mandatory national Phase II control guidelines that apply directly to Phase II storm water activities without a permit. The national pretreatment categorical effluent guidelines is an example of this approach. Permits by rule or general permits without application or reporting requirements are a similar concept. A variation on this approach might include the development of minimum categories or classes of BMP's or pollution prevention approaches with a requirement that elements from each class be chosen and implemented on a facility or system specific basis. At one level, this approach would appear to reduce the regulatory and administrative burden associated with submission of Phase II storm water applications. However, as a technical matter, it may be extremely difficult to develop one national rule that appropriately addresses all Phase II storm water activities. Developing such a rule may take a significant amount of time and may also entail substantial monitoring and data collection. A further issue upon which EPA solicits comment is whether a national rule would be the most effective approach given that many members of the Phase II universe may not be familiar with national regulations and may not even be aware that such requirements apply to them. EPA recognizes that implementation of control strategies other than NPDES permitting would probably require statutory change and requests comments on what changes would be appropriate.

(d) Rensselaerville focus groups. Focus groups identified several common themes with regard to controls that should be put in place for Phase II:

(i) Focus groups recommended that if a permitting process is to be continued for Phase II sources, NPDES general permits should be used, and the focus should be on the implementation of effective BMP's. Participants felt that permits should be simpler, less costly, and that EPA should make absolutely clear to applicants what information is required through the use of checklists of inclusion, a menu of potential BMP's, and other documents to assist permitees. The team members again stressed that exemptions from permitting should be available for sources not contributing to water quality problems.

(ii) The teams concluded that education is often overlooked and that it should be a primary component of any Phase II program. Team members felt that education is important for all audiences and that local level education

for the public and affected industry is critical to the success of the program.

(iii) There was an agreement among teams that there should be more emphasis on voluntary programs, perhaps similar to those under the 319 nonpoint source program. Groups also suggested that for facilities that have contact with storm water, there should be limited additional governmental intervention, but rather an emphasis on pollution prevention incentives, BMP's, and specific pollution prevention techniques. Participants stressed that pollution prevention should be emphasized, particularly with new development. Some suggested prevention methods included: recycling storm water, good housekeeping practices, plantings to minimize runoff, street sweeping of work areas on a daily basis, storm water collection methods, coverage of storage areas, changing manufacturing processes to minimize pollutants and better controls of air emissions.

(iv) Groups felt that there should be correlation between the severity of the problem and the degree of controls required and that fines and fee structures could be used as "carrot-stick" measures to aid implementation.

3. Deadlines

Section 402(p) presently provides that the current prohibition against permitting Phase II sources expires on October 1, 1992. EPA solicits comment on the possible options for alternative deadlines for Phase II permit application requirements and statutory revisions of the CWA. One option is for Congress to extend the current October 1, 1992 deadline for Phase II sources. Under this option, EPA requests comment on what the new Phase II date should be and why one particular extension is more appropriate than another. For example, one possible date might be October 1, 1995, to allow one year for additional data gathering and public input on appropriate Phase II sources and control strategies and then two additional years to propose and finalize Phase II regulations.

Another strategy might be to adopt a phased set of Phase II deadlines with high priority storm water sources covered first and lower risk sources addressed at a later date.

A third approach follows option 1 under Targeting; that is, to eliminate the Phase II deadlines and follow option 1 or direct EPA to follow some other option.

Focus group recommendations from the Rensselaerville study suggested that a minimum of 2–3 years is needed to prepare for Phase II, with at least a year dedicated to looking at data gained from Phase I of the storm water program and other documents such as the first Report to Congress. Participants also felt that the effectiveness of presently used BMP's needs to be looked at to determine variations in effectiveness between different geographic locations and pollutants.

III. Request for Comments

EPA is requesting comments on all aspects of the Phase II storm water permitting program. EPA is soliciting general comments on environmental objectives and economic impacts, as well as specific recommendations and implementation advice on each of the options outlined above. Based on comments received and the results of the two studies required under CWA section 402(p)(5), EPA may propose a rule under section 402(p)(6) or solicit additional comments on options again when more data becomes available. In addition, EPA welcomes data or information from ongoing studies that support specific comments or recommendations.

A. General Issues for Comment

Based on the discussion above and the President's memorandum on reducing the burden of government regulation, EPA requests comment on the advantages and disadvantages of each option outlined above as well as any other potential approaches in terms of the following factors.

1. How well does the approach perform with respect to the environmental goals of protecting water quality, reducing pollutant loadings, and achieving designated uses in impaired waters? EPA requests comment on which of these approaches most lends itself to the documentation and establishment of environmental baselines and identification of appropriate environmental indicators against which to evaluate progress. EPA specifically solicits input on appropriate environmental indicators in connection with any of the approaches outlined above or identified by a commenter.

2. Does the option balance the need for regulation to protect/improve the environment with the desire to minimize the regulatory burden and maximize the cost effectiveness of the approach?

3. Does the option help to reduce the regulatory burden on potential permittee, while still maintaining environmental benefits?

4. Does the option help to reduce the administrative burden on Federal, State and local government, so that resources are used to address important environmental problems efficiently?

5. To what extent does the option support or provide an incentive or additional flexibility for implementing pollution prevention and other innovative permit approaches?

6. Does the option allow or encourage the use of market incentives or trading to promote greater or more effective loadings reductions and water quality improvements?

7. What is the impact of the proposed approach on small businesses [22] and communities?

8. does the option allow consideration of the issue of affordability as a factor in determining which Phase II sources should be controlled? For example, some data indicates that average per capita income in suburban fringe areas is substantially higher than in core cities. Does the option allow this to be factored in when identifying high priority groups or selecting appropriate control strategies?

EPA requests specific implementation recommendations based on the respondent's general evaluation of the options outlined above. EPA also seeks detailed comments on how the option will be implemented and ways to refine the respondent's preferred approach. For example, address issues of affordability, cost effectiveness and possible funding mechanisms and sources, in addition to providing case examples where available of successful State or local implementation of a preferred option. Respondents should also consider the need for statutory changes or rulemaking to implement recommended approaches.

B. Current Classification of Regulated Discharges

The current regulatory framework of Phase I is summarized in appendix A. This information may help respondents to understand which types of municipalities and commercial and light industrial activities are not currently regulated under Phase I of the program. Sources exempted from Phase II and some sources potentially covered under Phase II are summarized in appendix B.

IV. Review and Analysis Requirements

Various reviews and analyses are required to assess the economic or paperwork impact of new rulemaking activities under Executive Order 12291, the Paperwork Reduction Act (44 U.S.C. 3501. et. seq.), and the Regulatory Flexibility Act (5 U.S.C. 601, et. seq.).

[22] With respect to impacts on municipalities, the agency requests comments on options municipalities have for generating the revenue required to run such programs.

These assessments are not necessary for this notice, which merely requests comments on ways to reduce the regulatory burden of potential future rulemaking.

Dated: September 1, 1992.

Martha G. Prothro,

Acting Assistant Administrator.

Appendix A. Facilities Covered in Phase 1

1. Industrial Facilities

EPA has defined the term "storm water discharge associated with industrial activity" in a comprehensive manner to address over 100,000 facilities. All storm water discharges associated with industrial activity that discharge directly to waters of the United States or through municipal separate storm sewer systems are required to obtain NPDES permits, including those which discharge through systems located in municipalities with populations of less than 100,000. Discharges of storm water to a combined sewer system or to a Publicly Owned Treatment Works (POTW) are excluded. Facilities with storm water discharges associated with industrial activity include: manufacturing/industrial facilities; construction operations disturbing five or more acres; hazardous waste treatment, storage, or disposal facilities; landfills; certain sewage treatment plants; recycling facilities; powerplants; mining operations; some oil and gas operations; airports; and certain other transportation facilities. Operators of industrial facilities that are Federally, State or municipally owned or operated (with the exception of certain facilities owned or operated by a municipality of less than 100,000 people [1] that meet the description of the facilities listed in 122.26(b)(14) (i)-(xi), described below, must also submit applications.

SUMMARY OF INDUSTRIAL ACTIVITIES COVERED UNDER PHASE I OF THE STORM WATER PROGRAM

40 CFR 122.26(b)(14) Subpart	
(i)	Facilities subject to storm water effluent limitations guidelines, new source performance standards, or toxic pollutants effluent standards under 40 CFR, Subchapter N [except facilities which are exempt under category (xi)].
(ii)	Facilities classified as: SIC 24 (except 2434)—Lumber and wood products. SIC 26 (except 265 and 267)—Paper and allied products. SIC 28 (except 283 and 285)—Chemicals and allied products. SIC 29—Petroleum and coal products. SIC 311—Leather tanning and finishing. SIC 32 (except 323)—Stone, clay and glass products. SIC 33—Primary metal industries. SIC 3441—Fabricated structural metal. SIC 373—Ship and boat building and repairing.
(iii)	Facilities classified as: SIC 10—Metal mining. SIC 11—Anthracite mining. SIC 12—Coal mining. SIC 13—Oil and gas extraction. SIC 14—Nonmetallic minerals, except fuels.
(iv)	Hazardous waste treatment, storage, or disposal facilities, including those that are operating under interim status or a permit under Subtitle C of the Resource Conservation and Recovery Act (RCRA).
(v)	Landfills, land application sites, and open dumps that receive or have received any industrial wastes including those that are subject to regulation under subtitle D or RCRA.
(vi)	Facilities involved in the recycling of material, including metal scrapyards, battery reclaimers, salvage yards, and automobile junkyards, including but limited to those classified as: SIC 5015—Motor vehicle parts, used. SIC 5093—Scrap and waste materials.
(vii)	Steam electric power generating facilities, including coal handling sites.
(viii)	Transportation facilities covered by the following SIC codes which have vehicle maintenance (including vehicle rehabilitation, mechanical repairs, painting, fueling, and lubrication), equipment cleaning operations, or airport de-icing operations, or which are otherwise listed in another category, are included. SIC 40—Railroad transportation. SIC 41—Local and suburban transit. SIC 42 (except 4221-25)—Motor freight and warehousing. SIC 43—U.S. Postal Service. SIC 44—Water transportation. SIC 45—Transportation by air. SIC 5171—Petroleum bulk stations and terminals.
(ix)	Treatment works treating domestic sewage or any other sewage sludge or wastewater treatment device or system, used in the storage, treatment, recycling, and reclamation of municipal or domestic sewage, including lands dedicated to the disposal of the sewage sludge that are located within the confines of the facility, with a design flow of 1.0 Million Gallons per Day (MGD) or more, or required to have an approved pretreatment program under 40 CFR Part 403. Not included are farm lands, domestic gardens, or lands used for sludge management where sludge is beneficially reused and which are not physically located in the confines of the facility, or areas that are in compliance with Section 405 of the CWA.
(x)	Construction activity including clearing, grading, and excavation activities except operations that result in the disturbance of less than 5 acres of total land area which are not part of a larger common plan of development or sale[1].
(xi)	Facilities under the following SICs [which are not otherwise included in categories (ii)-(x)], including only storm water discharges where material handling equipment or activities, raw materials, intermediate products, final products, waste materials, byproducts, or industrial machinery are exposed to storm water[1]. SIC 20—Food and kindred products. SIC 21—Tobacco products. SIC 22—Textile mill products.

[1] In the Intermodal Surface Transportation Efficiency Act of 1991, Congress provided that industrial activities owned or operated by municipalities with a population of less than 100,000 be placed into Phase II of the storm water program with the exception of airports, power plants and uncontrolled sanitary landfills.

SUMMARY OF INDUSTRIAL ACTIVITIES COVERED UNDER PHASE I OF THE STORM WATER PROGRAM—Continued

40 CFR 122.26(b)(14) Subpart	
	SIC 23—Apparel and other textile products. SIC 2434—Wood kitchen cabinets. SIC 25—Furniture and fixtures. SIC 265—Paperboard containers and boxes. SIC 267—Converted paper and paper board products (except containers and boxes). SIC 27—Printing and publishing. SIC 283—Drugs. SIC 285—Paints, varnishes, lacquer, enamels. SIC 30—Rubber and misc. plastics products. SIC 31—(except 311)—Leather and leather products. SIC 323—Products of purchased glass. SIC 34 (except 3441)—Fabricated metal products. SIC 35—Industrial machinery and equipment, except electrical. SIC 36—Electronic and other electric equipment. SIC 37 (except 373)—Transportation equipment. SIC 38—Instruments and related products. SIC 39—Miscellaneous manufacturing industries. SIC 4221—Farm products warehousing and storage. SIC 4222—Refrigerated warehousing and storage. SIC 4225—General warehousing and storage.

[1] On June 4, 1992 the United States Court of Appeals for the Ninth Circuit found that EPA's rational for exempting construction sites of less than five acres and certain uncontaminated storm water discharges from category xi light industrial facilities from Phase I of the storm water program to be invalid and has remanded these exemptions for further proceedings (see *Natural Resources Defense Council* v. *EPA* No. 91-70176).

Source: FEDERAL REGISTER, Vol. 55, No. 222, p. 48065, November 16, 1990.

2. Municipal Facilities

"Municipal separate storm sewer" is defined as any conveyance or system of conveyances that is owned or operated by a State or local government entity designed for collecting and conveying storm water which is not part of a Publicly Owned Treatment Works. The application requirements do not apply to discharges from combined sewers (systems designed as both a sanitary sewer and a storm sewer). Municipal separate storm sewer systems that are addressed by the November 16, 1990 regulations include storm sewers located in one of 173 cities with a population of 100,000 or more; located in one of the 47 counties identified by EPA as having large populations in unincorporated, urbanized areas; and systems that are designated by the Director based on consideration of the location of the discharge with respect to waters of the United States, the size of the discharge, the quantity and nature of the pollutants discharged to waters of the United States, and other relevant factors. These are named in Appendices F–L of the November 16, 1990, regulation.

INDUSTRIAL AND MUNICIPAL PERMIT APPLICATION DEADLINES

Type of Application	Deadline	
● Individual	October 1, 1992	
● Group	Part 1	Part 2
All industrial activities except those owned or operated by a municipality with a population of less than 250,000..	September 30, 1991	October 1, 1992
Industrial activities owned or operated by a municipality with a population of 100,000 to 250,000..	May 18, 1992	May 17, 1993
● General Permit NOI	Deadline established in the general permit, but no later than October 1, 1992 for existing sources.	

	Part 1	Part 2
Large Municipalities	November 18, 1991	November 16, 1992
Medium Municipalities	May 18, 1992	May 17, 1993

Appendix B. Potential Universe of Phase II Dischargers

Phase II potentially includes all point source discharges of storm water to waters of the United States (including Municipal Separate Storm Sewer Systems) that are not regulated under Phase I of the storm water program (See Appendix A). The following table illustrates those types of operations which have been statutorily exempted from both Phase I and Phase II of the NPDES storm water program along with a general list of potential Phase II sources:

Statutory / Regulatory exemptions:	● Non Point Source Silviculture Activities. ● Agricultural Runoff and Irrigation Return Flows. ● Uncontaminated discharges from Mining, Oil and Gas Operations.
General categories of sources	● All municipalities with populations less than 100,000.

	● All industrial activities not regulated under Phase I (including those owned/operated by municipalities under 100,000) (tank farms, "auxiliary facilities"). ● Commercial activities with industrial components (gas stations, dry cleaners). ● Construction activities involving less than 5 acres [1]. ● Large parking lots (shopping malls, stadiums). ● Residential property. ● Recreational areas (ski areas, golf courses, amusement parks). ● Livestock facilities (stables, feedlots not addressed by Phase I regulations [2], etc.). ● Greenhouses, nurseries.

[1] On June 4, 1992 the United States Court of Appeals for the Ninth Circuit found that EPA's rational for exempting construction sites of less than five acres from Phase I of the storm water program to be invalid and has remanded the exemption for further proceedings (see *Natural Resources Defense Council* v. *EPA* No. 91-70176).

[2] Feedlots, as a class of facilities, have been associated with high loadings of pollutants such as suspended solids, BOD, and nutrients such as nitrogen and phosphorus, and could be an example of a targeting approach based on high loadings.

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APPENDIX I

REPORT ON THE EPA STORM WATER MANAGEMENT PROGRAM (RENSSELAERVILLE STUDY)

United States
Environmental Protection
Agency

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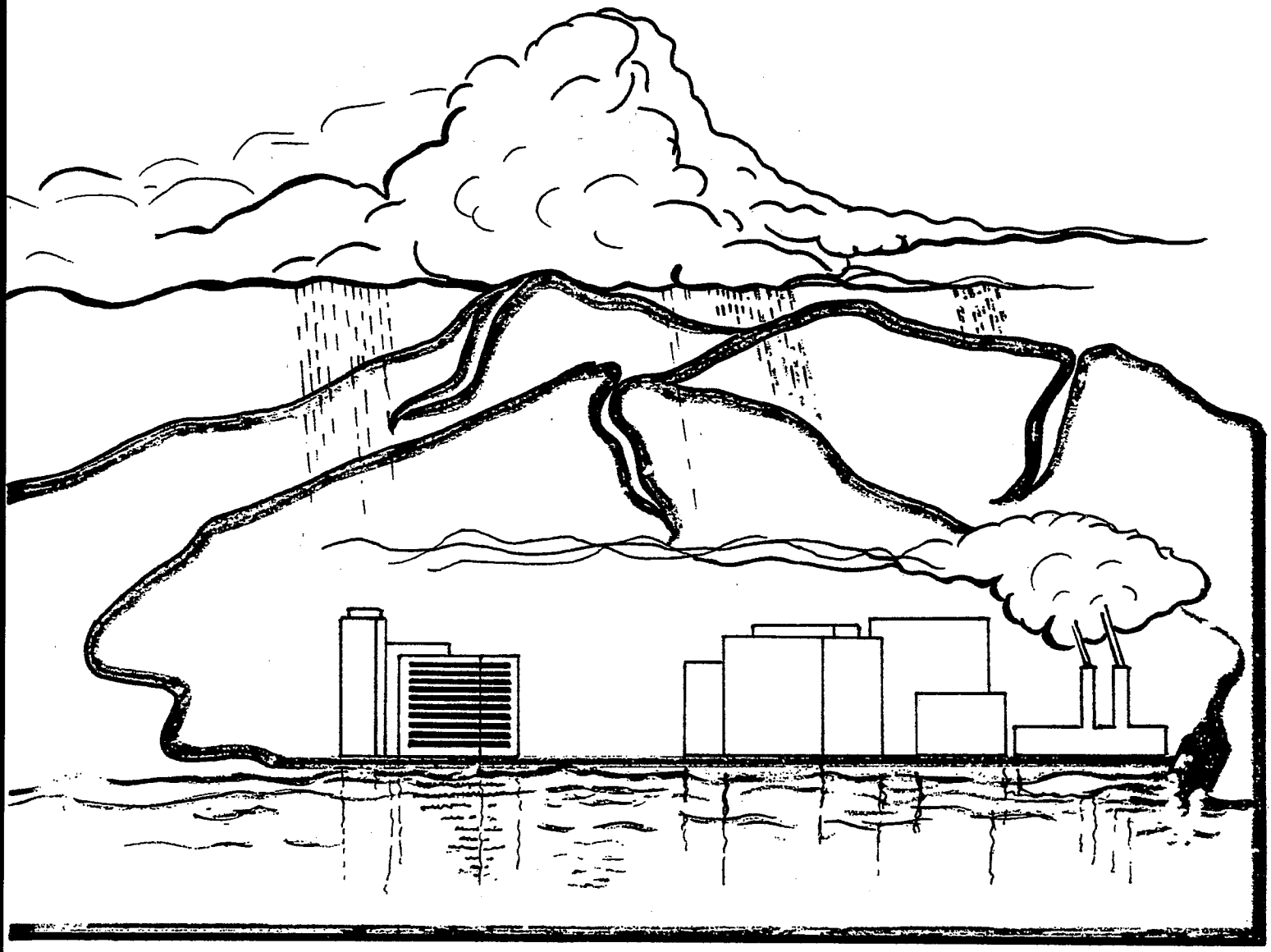

Report on
The EPA Storm Water Management Program

Conducted for the U.S. EPA Office of Wastewater Enforcement and Compliance
by The Rensselaerville Institute

Volume 1

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We also acknowledge the efforts of those persons who participated in the focus groups, the expert surveys, the public forums, and the "design team" session. The thoughtfulness of opinions and insights voiced is impressive.

We are encouraged by the willingness of people with very different perspectives to not only listen carefully to each other but to seek common ground. The prospects for collaborative work are strong.

Mary E. Marsters
Harold S. Williams
The Rensselaerville Institute

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EXECUTIVE SUMMARY

In December 1991, the Deputy Administrator of the U.S. Environmental Protection Agency (EPA) asked the Office of Water to undertake a research project with two objectives: 1) identify ways to improve and streamline the existing storm water regulatory program implemented by the agency under Section 402 (p) (2) of the Clean Water Act; and 2) define and annotate options for controlling sources of storm water runoff designed for Phase II of this same section.

In response to this request, the Office of Wastewater Enforcement and Compliance (OWEC) engaged The Rensselaerville Institute to develop a two-part project to gather and integrate diverse opinion and insight on ways to improve the efficiency and effectiveness of the existing Phase I program and the best possible response for the Phase II program designed to cover remaining storm water sources and problems.

Part I of the project was conducted during February and March, 1992 when six focus groups were held around the U.S. to gain user feedback on how the current regulations and implementation procedures could be improved and streamlined. These groups, which included representation by both public- and private-sector permittees as well as regulatory agencies, private consulting firms, industry, and environmental interests, identified numerous ways EPA and others could address permitting and compliance procedures seen as difficult or problematic.

Part II of the project began with an Expert Survey of 32 persons highly knowledgeable in storm water and its control who represented different perspectives (academic/research, state/local government, commercial development, environmental advocacy, and consultant/engineering) and different geographic areas. Experts were asked to respond to a set of options for targeting and controlling sources and to suggest additional alternatives as well. Insights on voluntary measures that have proven effective in storm water control were solicited through a separate survey of five experts in nonpoint program approaches.

Based on the results of these surveys, three public meetings were announced in the Federal Register and held in Denver, San Francisco and Washington, DC during June, 1992. Those attending were divided into teams and asked to define their own preferred strategies for a Phase II program response, including definition of sources to be regulated, the preferred method of control (permit-based or other) and their sense of both timetable and the role EPA should play.

Finally, a small group of insightful individuals representing diverse viewpoints from both point source and nonpoint source programs was convened for a strategy design meeting for the purpose of adding greater depth and breadth to one or more Phase II approaches identified in the public meetings. From this group, a ten-point strategy was created, as well as a series of recommendations to EPA on developing the second phase of the

storm water program.

This Executive Summary presents the findings from each of these activities in summary form. More complete recommendations are contained in the body of Volume I. The project data base is contained in Volume II.

Summary of Findings on Improving Phase I of the Storm Water Program

Forty individuals participated in focus groups held in Atlanta, GA; Hartford, CT; Chicago, IL; Washington, DC; Seattle, WA; and Phoenix, AZ. Together, the participants included all identified viewpoints and separable interests--including EPA regional staff, state and local government officials, engineering consultants, environmental advocates, and representatives of corporations included in Phase I permitting.

Participants responded to a set of questions which probed for opinion and insight on such matters as the unclear aspects of the Phase I regulations, additional steps that should be taken to simplify the process and help permittees to achieve compliance, and the relative merits of individual and group permits. In addition to participant responses to core questions, the afternoon of each session was used to further elaborate problems and solutions of interest to participants in an informative format.

While many issues raised were location- or source-specific, some spanned geographic and demographic boundaries. Eight issues common across all focus groups were identified as key areas to be clarified and/or modified to improve program implementation:

1. EPA has not been clear about the intended goals of the regulations. A stronger sense of the relative importance of storm water in the framework of environmental risk is needed, as is clarity about short range and long term targets. There is a difference, for example between clean water standards and stream health standards. It is clear that there are storm water permits. It is not clear how the permits reflect a coherent program.

2. The expense of program implementation is significantly higher than EPA has estimated. There is great concern over what the program's real costs have been in terms of dollars and manpower costs of preparing a permit application, and the anticipated costs of achieving compliance. A broader concern: municipalities now beleaguered by resource shortfalls cannot reasonably afford the combined costs of compliance with all environmental regulations.

3. The administrative complexity of the program is enormous at the federal, state and local levels, and has quickly outpaced the availability of resources and manpower needed to carry it out. In some cases, field staff have been

pulled in simply to process the paperwork involved.

4. Clarification is needed on the roles and expectations EPA has for itself, states and permittees. What is clear to everyone is that EPA does not have the capacity to administer and enforce the program alone. This cannot be seen as an EPA program administered in a "command and control" style totally from Washington. It must involve active participation, not simply passive compliance, from all levels involved.

5. More technical support for the program is needed. Expanded information explaining the regulations and how to implement them is especially needed. Also, there should be less "national level" support and more focus on regional conditions. Much of the content of storm water workshops held at EPA headquarters is irrelevant to any given participant.

6. States need EPA to either clarify how to interpret unclear points of the regulations, or allow them the latitude to make the interpretations themselves. One unclear area is the inconsistencies and inequalities created by use of industrial SIC codes in such areas as transportation. Another murky area is the group application process.

7. EPA should consider consolidating programs in order to address water pollution in an efficient and cost-effective manner. A watershed approach is preferable to current practices of separating problems by media.

8. General permits are "the way to go" and EPA should continue to focus on and accelerate efforts in this direction.

Many focus group members made a point of indicating their pleasure with the focus group format used and the ways in which EPA had 1) encouraged interaction and customer insight and 2) listened carefully to their advice. A complete report on focus group responses and conclusions is contained in the body of this publication.

Summary of Findings on Designing Phase II of the Storm Water Program

Expert Survey

The second part of the Rensselaerville project began with a survey of a select group of 32 point source storm water program experts from across the country. The purpose was to solicit opinions on ways to implement the second phase of the storm water program. Five perspectives were represented: academic/research; commercial development; consultant engineering/legal; environmental advocacy; and state/local government. A first mail-back survey round gained opinion and consensus on relevant issues and

options for addressing Phase II sources. Data from the first set of returned surveys were analyzed and given back to participants in a second survey round, which refined positions and created more options for Phase II consideration.

To ensure inclusion of all critical perspectives, five nonpoint source program experts were asked to provide feedback, with emphasis on potential voluntary approaches for addressing Phase II sources.

While approaches recommended differed by profession and geography, these common targeting themes emerged for identifying whom to include in Phase II:

- develop a geographically-based phasing plan by watershed impairment/severity of threat;
- determine selection criteria for pollution sources and use these to identify municipalities that should participate;
- do pilot projects first, evaluate, and then develop and implement a strategy;
- encourage and fund comprehensive basin research and planning to guide targeting;
- require Phase II industries to be covered under Phase I general permits;
- develop national guidelines, and leave selection of sites and methods to state discretion;
- require smaller communities (< 100,000) to apply for permits only when their storm water contributes a significant pollution problem;
- designate problem areas, establish permit requirements for municipals regardless of population, and allow municipals to exclusively regulate industries; and
- initiate a focused dialogue with key stakeholders (applies to both targeting and controls).

Common themes expressed for control strategies included:

- build a Best Management Practices (BMPs) menu that can be used by states to implement and verify progress;

- require localities to select from a list of BMPs the ones most appropriate for their needs and apply industry-specific BMPs nationwide with allowance for state/local officials to modify;

- provide nationwide public education and community-wide public education on the need for storm water control;

- establish national or industry-specific minimum practices for controlling storm water;

- implement good housekeeping and source reduction practices;

- require routine certification and audit of storm water pollution plans and practices;

- establish industry-specific and watershed-specific BMPs; and

- establish BMPs required nationwide and strictly enforce. Require facilities to further treat storm water discharges where BMPs are not effective.

The strongest additional factor in nonpoint survey responses was the degree of emphasis placed on education at all levels, including the general public, local and state officials, and local businesses and industry. Education was seen as the key to making voluntary approaches effective. Voluntary compliance, in turn, was then advanced as highly cost effective.

Respondents feel that EPA must be the "stick" that would fall--with permit requirements, fines, etc.--if a storm water source does not voluntarily take action and achieve certain minimum goals. But limited manpower and financial resources form a rationale for <u>not</u> addressing Phase II with the costly conventional federal mandates of Phase I.

<u>Public Meetings</u>

Three meetings were conducted to gain public responses to options for targeting and controlling Phase II sources. They were held in Denver, CO; San Francisco, CA; and Washington, DC during June, 1992. At each meeting, three experts selected from the Expert Survey process presented their ideas on a regulating strategy for the moratorium sources. Participants were then divided into small task teams, and given the charge of devising their own strategies for targeting and controlling Phase II sources. A strategy template was provided to guide group consideration of three key issues: 1) who should be covered under Phase II; 2) what controls are needed; 3) over what timeframe the program should be implemented. At the end of each public meeting, the task teams presented their options to other participants for discussion.

Common strategy characteristics emerged, in many cases paralleling those apparent in the expert survey. For targeting:

- Targeting should be done by watershed. Information gathered from Phase I should help identify sensitive watersheds. This may require intergovernmental agreements.

- The focus should be on "bad actors", i.e., those that are known problem sources. The ones most frequently identified were: gas/auto service industries, transportation, highway systems, land use development and agricultural sources. There needs to be the ability for facilities not contributing impairment of water to gain an exemption from permits, fees, implementation of BMPs. Categories are an ineffective way to designate covered sources - should be done by the degree of risk a given facility poses, because it may not be a whole industry, but rather individual facilities.

- Small municipalities should be included, but they should have a much simpler application process. Or, only small municipalities where a storm water problem is identified should there be required action.

- EPA should defer on selecting targeted sources until the agency has carefully looked at the data gathered during Phase I. Numerous sources of information are available which would help determine targeting priorities, e.g., information gathered through 305b reports, information from Phase I program sources, the NURP study.

For needed and desirable controls, these themes emerged:

- If a permitting process is to be continued for point sources, NPDES general permits should be used, and focus should be on implementing Best Management Practices (BMPs). Permits should be simpler, and much less costly. EPA should make clearer to the applicant what information is required, e.g. provide the permittee with a "checklist of inclusions" for the application, develop a menu of BMPs. Permit exemptions should be granted to those targeted sources who offer no contribution to the problem.

- Education should be seen not as an "add-on", but rather as a primary tool for effective control. Locally implemented education for public and industry is especially important; the premise is that information and conviction born of education will encourage many to take the needed preventive and remedial steps.

- More emphasis should be placed on voluntary programs, e.g., 319 nonpoint

source-like programs. For facilities with contact with storm water, there should be little or no government intervention, but rather emphasis on pollution prevention incentives. BMPs, and measures of pollution prevention.

Pollution prevention programs should be emphasized, particularly with new development. Some suggested prevention methods included: recycling storm water, "good housekeeping" practices, plantings to minimize runoff, street sweeping of work areas on a daily basis, storm water collection methods, coverage of storage areas, changing manufacturing processes to minimize pollutants, and improvement of air emissions.

- ☐ Closer correlation should exist between the severity of the problem and the degree of controls required. Fines and fee structures could be used as "carrot-stick" measures.

- ☐ BMPs should be required based upon the specific pollutant problem. EPA should develop a menu of BMPs to assist businesses in determining the appropriate BMP for their problem.

In terms of a timetable for phasing in Phase II, two widespread opinions emerged:

- ◇ A minimum of two years is needed to prepare for Phase II, with at least a year dedicated to looking at data gained from Phase I of the storm water program. Effectiveness of presently used BMPs needs to be studied to determine differences in effectiveness between geographic locations and pollutants.

- ◇ Whatever the period established for phase-in, it should not begin <u>until</u> promulgation of the regulations.

A final question in the strategy template: **"For whatever strategy is chosen, what could EPA do to make the decision-making process for Phase II more responsive?"** generated responses focused on some common themes:

- ⌂ Coordinate information dissemination, e.g., set up regional clearinghouses offering such program information as general permit writing, effective applications of BMPs, and examples of successful efforts from programs around the country.

- ⌂ Provide funding not for program implementation but for needed research, e.g., on BMP effectiveness, and for demonstration projects.

- ⌂ Set broad guidelines for the program and establish minimum standards, and then allow state and local regulatory agencies determine how to achieve

them.

- Develop and implement training programs for regulators, including regional and state, on the program. These people are the ones who will be the informational source for the regulated community, and need to know the details of the program.

As with the focus groups the participants in the public meetings felt positive about the format used. A mail-back survey returned by more than 30% of meeting participants showed that they strongly favored this interactive process over what they perceived as the conventional practice of a stream of public comments that encouraged adversarial positioning and boredom for those listening. Comments of attendees included:

- "The opportunity to formulate an entire strategy to deal with this issue was very useful;"

- "I obtained a better point of view of government's problems and felt that government representatives also obtained a better point of view of industry's problems;"

- "Result was a much less confrontational and much more problem-solving atmosphere;" and

- "It was a valuable way to address drafting of regulations, allowing the regulated community to feel a part of the process."

The body of this report contains a further elaboration of the process and the ways in which it might be used by the EPA in other communication and outreach efforts.

Design Team Meeting

A meeting of seven point and non-point storm water program experts, all of whom were survey respondents, and selected EPA staff was convened in Washington DC on September 17-18, 1992. The purpose was to gain the experts' varied insights on development of the Phase II storm water program and to build a strategy, or multiple strategies, for addressing Phase II sources.

Many discussions were specific to certain types of activity--not only municipal or industrial, but to specific kinds and levels of enterprise. Others focused on regional differences--for example the strong distinctions from places that are uniformly wet, uniformly dry, or highly volatile in hydrological terms. Still others found differentiation in scale--such as the difference in impact a regulation would have on a city as compared to a small town. These distinct findings are contained in the full report which follows in this volume.

A broader set of ten recommendations emerged for the major Phase II challenge which generally transcend such differences. They include:

1. **It is possible and desirable to identify priority target areas for which there is widespread consensus concerning their contribution to water pollution.** These areas begin with new development and redevelopment--both residential and commercial. They also include transportation corridors, dense existing development and automotive services.

2. **EPA needs to communicate more clearly and regularly with everyone impacted by the storm water regulations.** The priority focus should be less on the amount of communication and more on different kinds of communication.

3. **EPA could improve program effectiveness, efficiency and cost control in Phase II by "starting small".** The concept of regional and even local prototypes is a way of getting proposed new Phase II frameworks into the hands of users in prompt fashion to build and refine based on early use.

4. **Selectivity in data collection and monitoring is essential.** At present, some data collection frameworks consume tremendous time and money only to yield bad or useless data or murky or disputed conclusions. At other times, very simple actions taken with known consequences require simple verification, not extensive measuring.

5. **More customer differentiation is also needed.** At present the mind-set appears to be that one size fits all. While giving the appearance of equity, this concept actually creates strong inequalities. The same programs and regulations that befit a large corporation or municipality are simply not equitable for smaller enterprise and communities, for example.

6. **While the ultimate goal is water quality standards, this is very difficult to achieve and/or to measure in the short term.** Therefore, while retaining water quality standards as the ultimate goal, EPA should be focusing on best management practices, and in particular those that reflect preventive and non-structural solutions.

7. **The most functional unit of both analysis and intervention is the watershed.** Most people in our samples for opinion and recommendation strongly suggested the watershed approach--not only on the macro level (e.g., Chesapeake Bay) but the micro-level as well.

8. **EPA's role is to offer technical support and direction more than program funding or even full guidelines for state and local implementation.** In particular, building useful data bases and collection methodologies not only on water quality but on practices to achieve it is critical. Such practices should include education, given that prevention and voluntary compliance are much less costly than litigation.

9. **A collaborative approach to developing effective solutions is possible.** The interactive elements of this project are one reflection of the ability of those with strikingly different perspectives (ranging from strong environmental protection to a focus on economic development) to work cooperatively.

10. **Agriculture's absence from the storm water program is notable and regrettable.** In many regions, agriculture (which includes livestock as well as crops) is a primary contributor to surface water pollution. Permitting or in other ways controlling the transport of agricultural products introduces intervention too late.

The remainder of Volume I amplifies these findings and presents the rationales and key data points which underlie them. Volume II includes the complete data base, including all instruments used to collect and analyze information.

PART I: IMPROVING PHASE I OF THE STORM WATER PROGRAM

In December, 1991, the Deputy Administrator of the U.S. Environmental Protection Agency asked the Office of Water to undertake a project that would achieve two results: first, identify ways to improve and streamline the existing storm water regulatory program currently being implemented by the agency; and second, develop options for controlling sources of storm water runoff not currently required to be permitted under Section 402(p)(2) of the Clean Water Act.

In response to this request, the Office of Wastewater Enforcement and Compliance (OWEC), working with The Rensselaerville Institute, developed a two-part project. This section addresses the outcomes from Part I, which focused on identifying improvements to the existing regulatory program.

Description

As the first part of The Rensselaerville Institute's project to help EPA assess the effectiveness and efficiency of the existing Storm Water Program, focus groups were held in diverse regions of the country to gain feedback on how the regulations promulgated on November 16, 1990 could be streamlined and improved. Six such meetings comprising representatives from state, municipal, private industrial and environmental groups were conducted between February 24 - March 2, 1992.

A total of 40 individuals participated in the focus groups, which were held in Atlanta, GA; Hartford, CT; Chicago, IL; Washington, DC; Seattle, WA; and Phoenix, AZ. The format for each meeting was the same: participants provided feedback on eleven questions developed by EPA and Institute staff. The questions:

1. Which aspects of the storm water regulations are least clear?

2. What additional steps would be helpful in assisting permittees achieve compliance in the allotted timeframe? Who should take those steps?

3. Exactly what kinds of guidance and information are needed to help people implement the program? How would you prioritize these listed storm water program activities in terms of their usefulness?

4. Is there a need for EPA to do more national workshops on the storm water regulations? What about regional or local workshops? On which subjects?

5. What support should states, as opposed to EPA or other organizations, be expected to provide to their "universe" of permittees? What resources do they need in order to provide those supports?

6. If you had to name three ways to streamline the permitting process, what would they be?

7. What could EPA do to encourage those states without general permit authority to get it? What steps are needed to get general permits out? What simple, short-term grassroots efforts can associations and trade groups take to help this effort, and how could EPA support those efforts?

8. What outreach efforts to explain to permittees what they have to do to comply with the regulations have been most effective to date? Are there informational pieces that EPA could prepare that would best help these efforts?

9. What are the techniques, methods or strategies you would recommend to help permittees achieve water quality standards? In what timeframe should permittees be required to comply with WQS?

10. Given that construction activities are most often local in nature and temporary in duration, do you have suggestions about how EPA could more effectively regulate such activities?

11. What suggestions would you offer in terms of the most efficient way to enforce EPA existing regulation requirements, both application requirements and substantive permitting requirements?

Responses to question #6 were revisited in the afternoon of each session, when participants were asked to further define their recommendations, indicate who they felt should be responsible for initiating the changes, and list the initial steps they would take.

Response summaries were drafted following each meeting and sent to participants for additions and modifications. Their changes were incorporated into their respective reports. This overall report summarizes, interprets, and analyzes group discussions and conclusions.

Focus Group Findings

Despite the many issues surrounding implementation of the regulations, the consensus of all focus groups, including industrial representatives, was that storm water control is needed and appropriate. There was general agreement that storm water is a significant contributor to water pollution. Some felt that a regulatory program was appropriate to address the problem. A number of participants expressed that, overall, the storm water program is significantly more rational and easier to deal with than other EPA water programs, for example, the wetlands program.

Yet the storm water regulations still inspire much confusion and frustration. There is frustration with EPA, as well. Many felt there was a lack of consideration given to their inputs by the agency prior to promulgation of the regulations, and some thought that EPA had been unresponsive to questions and concerns voiced since the regulations went into effect. When pressed, however, most admitted that they perceived this to be an endemic or generic problem of government. For a few, this perception will not be changed. However, most were impressed that EPA was now willing to actually look at the storm water program and solicit input from those dealing with the regulations on how they could be improved or streamlined.

Reservation was voiced, however, that EPA would do nothing with the recommendations generated from these focus groups. Their concern was that the results would have as little impact on EPA's decision-making and responsiveness as had previous efforts to

make their opinions known.

It is critical, therefore, that EPA identify those procedural changes made in response to the recommendations, and make them known both to focus group participants specifically and to the permitted and regulatory communities in general.

The range of concerns voiced was large, and differed between geographic regions and the representational make-up of the group. Each group raised issues that were quite specific to themselves or their region, e.g., New York City was concerned about the effects of tidal flow and backwater as they relate to water quality; Utah and other arid and semi-arid states were concerned about sampling procedures when there was scarce rainfall; Seattle felt that the regulations did not allow its storm water program to build on earlier work; general contractors do not understand why concrete mixing requires a separate permit even though it is done on the construction site, etc. The specificity of concerns for each group is reflected in the individual summary reports, which are included in Volume II.

Some issues and concerns identified, however, spanned geographic and demographic boundaries. They were raised across groups as key areas in need of clarification and/or modification. There were seven broad areas identified where members felt efforts should be made to improve and streamline the storm water regulations.

1. **Permittees and regulatory agencies feel that the EPA has not been clear about the intended goals of the regulations. A view of the "bigger picture" is wanted.**

   While group members agree that storm water is a contributory factor to water pollution, there does not seem to be an understanding of what EPA hopes to achieve with the regulations promulgated in November 1990. A frequently heard comment was that "the big picture" is missing. Participants felt that EPA has not been clear about how these regulations will accomplish the goal of achieving clean water, and in what timeframe. This has hampered efforts to comply because many do not understand what they should be setting as performance targets.

   One participant said, "What is a clean urban stream?" The point: participants were not sure what goals they need to attain to comply with the regulations and protect themselves from being sued or fined for non-attainment. Almost all participants felt that water quality standards were useful as the ultimate goal toward which to work, but were unachievable in a two- or three-year period. When asked what they felt would be a reasonable timeframe, estimates ranged from five to thirty years, with a few participants indicating that, given the large number of pollutant sources impacting on a given water body, achievement of water quality standards through the storm water program alone is a strong improbability. One participant stated that the scientific community's perspective is, "...there is no way water quality

standards can be achieved with known storm water technologies"; it will take further research and development of BMPs before water quality standards could be achieved.

It was clear that members need more guidance about where the program is headed. Participants want EPA to be more explicit about what should be achieved in terms of improvement of water quality in the timeframes that have been given and with the technologies that are presently available.

Group members were aware that environmental advocacy groups will bring pressure on EPA to hold to established numerical water quality standards, and that reducing or replacing them is not likely a viable option. As one representative from an environmental advocacy organization stated regarding water quality standards, "...(they are) the heart of the Clean Water Act." Participants felt, however, that EPA needs to explicitly acknowledge that cleaning up the waters of the U.S. is a long-term effort that requires federal, state and local governments to work in partnership with permittees rather than through "command and control" relationships. Permittees fear being sued for non-compliance when in fact they are making the best efforts possible.

Permittees and regulatory agencies want EPA to provide them the time and support they need to design and implement storm water programs that make sense in terms of effectiveness and cost. They feel that EPA, by not clearly stating goals, has hampered efforts to deal with the problem; permittees are not sure which approaches to take because they don't know what they have to achieve. They want the guidance and information necessary to implement the most appropriate measures available for their discharges, and the time to evaluate those efforts. As one group member observed, "...What is needed is a longer period (than the permit period) to do BMPs - and then monitor their effectiveness. Where necessary, go back and change things. It's an evolutionary process. This is not a quick tech fix! EPA is creating more problems than answers. October 1 should not be 1992, it should be 1995."

If EPA is to achieve success with the program, it needs to address confusion over program goals and timeframes. The agency needs to be explicit about what it expects industrial and municipal permittees to accomplish in the first permit period, what they expect them to achieve in the longer term, and what they anticipate the impact of the storm water program to be on overall water quality.

2. **The cost of program implementation is significantly higher than EPA estimates. There is great concern over what the program's real costs have been in terms of dollars and manpower.**

A great concern of focus group members was the excessive cost of preparing a

permit application, and the anticipated costs of achieving compliance. A number of state representatives indicated that implementation of their state program took, in terms of staff time alone, more than all other water programs combined - without the concomitant added federal dollars that those programs provided. That EPA has provided minimum federal dollars for the program is a major issue. Municipalities and industries were concerned with the significant additional costs of manpower and technology needed for both application and compliance. One focus group participant brought for discussion a study done by the School of Public and Environmental Affairs at Indiana University. The study has identified that the actual mean cost for Part 1 of the municipal application process for 59 cities exceeded by <u>six times</u> the EPA-estimated costs of the program [Gebhardt & Lindsey (1992), "NPDES Requirements for Municipal Separate Storm Sewer Systems: Costs and Concerns"].

That EPA has set aside some monies to assist in program development is not commonly known information. There was confusion among a number of focus group members about the availability and applicability of grant monies, e.g. 104(b) funds, that <u>are</u> dedicated to implementation of the program. For example, within the same focus group, one person said that they had applied for and received the funds to help prepare their application; another member replied that they were told that the monies could <u>not</u> be used for that purpose. Members of some groups were unaware that the funds were available at all. This indicates that communication from EPA has been inadequate in letting eligible groups know that there are some, albeit limited, dollars available to help them in setting up their programs, and that there has been inconsistent communication about the guidelines for use of those funds. Further, every person who indicated knowledge of the money also noted that the funds available were minuscule in comparison to what was needed to actually get their programs up and running.

Some states have developed the necessary revenue-gathering mechanisms to fund their storm water program. One state representative indicated that, by charging permit fees, they have been able to hire six staff people for the program. A few other state representatives indicated that storm water utilities had been successful in helping to raise the funds necessary for program operations. A significant number, however, contend that their state does not have the funds to implement the program, nor do they have a system devised to raise these funds. Therefore, wholehearted efforts are not being made to respond to the regulations. Further, some states have implied that they do not consider storm water a priority, and therefore are not willing to devote any portion of their budget to the program. This latter point creates a significant problem for the thousands of permittees in such a state that are then without a critical support system to provide them guidance and technical assistance.

The storm water field in general is perplexed that EPA could promulgate these

regulations, without at least providing "seed monies" to assist the application process and help states set up their own revenue-generating systems. To some, the message EPA sent by not providing funds is that the agency itself is not invested in the program. If EPA plans to continue to regulate storm water without providing financial assistance, one way it could assist permittees is to provide guidance and examples of successful fund raising systems that some states have devised, e.g., storm water utilities.

3. **The administration of the program is enormous. Clarification is needed on the roles and expectations EPA has for itself, states and permittees.**

Much of the controversy surrounding the regulations arises from unclear delineation of the roles, responsibilities and authority of each level. What is clear to everyone is that EPA alone does not have the capacity to administer and enforce the program. Therefore, much responsibility must fall on state and municipal levels. However, the regulations do not delineate the responsibilities of each level. Group members were clear that they want EPA to be more decisive and explicit about what is expected of states and municipalities in terms of administration and enforcement, and the areas where they will be allowed authority and flexibility in decision-making.

Some state and local governments have not waited for EPA to define their roles. The regulatory deadlines were powerful motivators for them to move forward without such guidance. Thus, frequently heard was states' hesitancy to discuss with EPA what they were doing programmatically, because they were afraid they might not be doing it "right", i.e. in accord with what EPA wants done. They were concerned about asking EPA for clarity they feared the agency might take away their assumed authority since it had not been specifically assigned in the first place. A number of state representatives admitted that they interpret the regulations in their own way rather than wait for EPA to provide interpretation. As one state representative put it, "...we looked at the regs as guidance rather than rules. We do it our own way. We are not sure if it is appropriate, (so) I have concerns asking for guidance from EPA because they may take away our latitude to make our own judgments."

The vagueness in assignment of responsibility and authority has clearly hampered program implementation. It may have been the intention of EPA to be less specific so that other entities would make their own interpretations, but they clearly do not feel comfortable assuming responsibility or authority. Many have been frustrated by the agency's lack of response when trying to gain clarity of the regulations. For example, one trade association representative stated that, in order to inform his membership about the regulations, he wanted to publish in their trade newsletter an article that outlined their members' responsibilities under them. To ensure that his interpretation was in accord with EPA's, he submitted the article to

EPA for review. In his words, "I waited a month, and when EPA did not respond, I went ahead and printed it. They [EPA] didn't like that."

Some state representatives said that they were unwilling to help industrial people make decisions on whether they are covered by the regulations, because they do not want to be held accountable when EPA has not specifically given states the authority to make interpretations of the SIC codes. Participants felt that the states are more likely than EPA to know the specifics of the industries in their boundaries, and also to know which ones are high-risk pollutant sources. But states do not feel that EPA has given them the authority to use that knowledge to make their own judgments on whether an industry is covered or not.

Industries also feel unsure about their responsibilities under the regulations, and are turning to the states for guidance. The regulations are unclear, for example, about what level of program implementation is expected in a given timeframe. As one state representative put it, "...there needs to be some guidance from EPA to the states on what (industries) need to do!"

States feel they have more knowledge of the industrial risks within their boundaries, and know what is needed to bring those risks into compliance. A number of focus group members cited the uselessness of having EPA develop requirements and guidance for any given industry when it did not understand specific industries. They felt it far more effective for EPA to work with industrial representatives when developing materials to ensure clarity and correctness. This would likely create the added benefit of gaining industry's commitment to achieving certain results.

Given the magnitude of these regulations, the lack of funding available to support implementation, the fiscal constraints under which all levels of government are operating, and the limited staff at each level, working in partnership with states and permittees rather than through a "command and control" relationship could get the program in place more quickly and maximize its effectiveness. EPA needs to determine each government level's responsibilities, be explicit about what decisions and flexibility can be allowed, and be clear about what results are expected from each level of government if given the authority to interpret certain aspects of the regulations.

4. More supporting information for the program is needed, and dissemination of that information needs to be improved.

Information supplementary to the regulations, explaining them and providing explicit information on how to implement them, was cited as a critical need that had only partially been met. All focus group members gave feedback on those pieces of EPA-generated information they thought was useful, what they felt was not helpful, and what other information they desired or felt was needed. They also

addressed the regulations themselves as a source of information.

a. Written Documents

Written information EPA has provided to supplement the regulations, such as guidance documents and supportive materials, received overall good reviews. Numerous participants stated that both the Industrial and Municipal Permit Application Guidances were helpful.

The primary problem with much of the written guidance and information is that it is coming out too late to be useful. A number of participants indicated that a model general permit would have been helpful, but that they were at the point of writing their own, so for them it was too late. Often group members' suggestions for specific informational documents were accompanied by the caveat that it was needed now, e.g., permit writers guidance; Model Permits for MS4s; a BMP manual; Construction Activity Guidance.

Not everyone wants to receive new information at this point in the program. A number of participants said, "Don't do anything...We have a track; anything that would confuse that would be a problem. Even clarification. We have an idea for what we want to do and if guidance comes out now, it might conflict with what we want to do."

One person commented that EPA should prepare guidance documents so that they can be released concurrently with promulgation of the regulations. This would avoid not having them ready in a useful timeframe. A number of participants felt that EPA should be more willing to release information in draft form if the final document is going to be late. EPA should make preparing information for Phase II of the program a priority; the timeliness of delivery is a reflection of the program's credibility and of EPA's commitment to the program. It is clear that those who have gone forth without the support of written guidance are going to be highly resistant to any input by EPA that would require them to modify what has already been done.

Dissemination of EPA documents has been inconsistent. Regions vary in their thoroughness of distribution. One group member said, "...EPA needs to be better at getting this stuff to us. I often have somebody walk into the office with something that has been out for three months that I have not seen." This frustration was echoed in a number of the focus groups. EPA needs to publish a list of available documents which people can request either in writing or through the Hotline.

b. Verbal Communications

The Storm Water Hotline received mixed reviews from group members. The primary response was that it effectively addressed very basic questions, but that the program had advanced quickly to the point where more technical information was needed. Trust in the ability of those answering the phones to address complex issues was low. However, this is not an unusual response to Hotlines; often callers complain that information given is inadequate, inconsistent, or not appropriate to the situation of the caller.

Some focus group members stated they were pleased with the response they had gotten from the Hotline. Some indicated that they were relieved just to have someone to call for program information. Others felt it was a good way to confirm their "hunches". Overall, given the size of the program and the number of phone calls that have been received, the perception of the Hotline is relatively positive.

Some alternative roles were suggested for the Hotline. Members stated that it could be used as an information clearinghouse, having available a list of sources that callers could turn to for more technical information. One person suggested that operators have lists of experts in categories to whom they could refer callers for more information.

One frustration voiced was that reaching EPA staff people was a problem. This has created for some the perception that EPA headquarters staff are unapproachable. On the practical side, however, responding to all the phone calls they receive would tie up all available staff for the duration of the program; headquarters staff would do nothing but answer phone calls. Yet it is important to recognize that this problem influences people's perception of EPA's commitment to the program. Perhaps with EPA's attention to the more substantive items listed in this report, e.g., getting documentation out in a more timely manner and with more thorough dissemination, etc., this perception will self-correct.

c. Workshops and Presentations

All groups felt that workshops of national scope were no longer needed, because the issues being dealt with were now more technically specific to certain industries or areas. The consensus was that state and local workshops, providing industry-specific guidance and information on water pollution control, were most needed. Most felt that such workshops should be sponsored and planned by trade associations and other membership associations like APWA, WEF, ASIWPCA, etc. rather than EPA. They did feel that EPA should be a speaker at the programs, and be willing to help address the federal perspectives in response to local concerns.

A main concern of group members, from coast to coast, is reaching those

industries who are covered by the regulations; many businesses covered under the regulations do not know that they must apply for a permit. Trade associations were recommended as one of the best ways to get to the harder-to-reach permittees (usually referred to as "Mom-and-Pops"), but even they are limited to those businesses who are members. Group members mentioned other avenues through which they have tried to reach these businesses, such as direct mailings to municipalities and working through Chambers of Commerce. None have been completely effective. Most members said that this was not solely EPA's responsibility, but also one of states, local governments and trade associations as well. EPA could support this effort by suggesting methods for reaching these businesses, and contacts at the national level that could be helpful, e.g., Small Business Administration.

d. The Regulations as Information

The Federal Register notice of the regulations was considered by participants to be a key source of information about the program. Numerous comments were made about its inability to convey needed information clearly and concisely. Length, layout, language and accessibility were identified as deterrents for many "laypeople" to comprehend them.

One member said the length was approximately 127 pages too long; he felt it should have been three pages, with a focus on what the regulations will do to reduce water pollution. Many felt that the regulations were not user-friendly because of the language used, which they referred to as "legalese". One person remarked, "What is needed is an English version of the regs!" The citations were claimed to be confusing, and some felt substantive requirements were "buried" in the wrong section, e.g., important permitted industrial activities were in the Definitions section, and municipal requirements were scattered throughout rather than placed in a "Municipals" section. Another noted that the three-column format was difficult to read for most not used to the Federal Register format.

Many noted that the Federal Register is a publication that may be picked up by some large businesses, but would rarely find its way into the smaller ones. Given the widespread impact of the regulations, there is valid concern that EPA views the Federal Register as a primary method to "get the word out." They felt this was not a good assumption, since circulation of the Federal Register is very limited, leaving the vast majority of those industries covered by the regulations unaware that they are affected.

There is need for a more clearly stated version of the storm water regulations. Trade associations have done a great deal to try to reduce the regulations to laymen's terms for their members. But when supplemental guidance documents, which are more reader-friendly than the regulations, are not quickly forthcoming

and the regulations provide the only source of information. confusion is inevitable.

5. **The regulations lack clarity on a number of key aspects. State authorities need EPA to either clarify these points of the regulations, or they need EPA to allow them the latitude to make the interpretations themselves.**

During each focus group, members discussed many particular points of the regulations that they had found unclear. These varied from group to group, depending on the perspectives represented. As one would guess, points that to a municipal person lacked clarity were often different than issues of concern to an industrial representative. For example, industrial representatives spoke of confusion with deadlines as a result of the Surface Transportation Act amendments, how to pick the appropriate permit to apply for, and how industries connected to municipal sewer systems should deal with the regulations. Municipal representatives, on the other hand, mentioned specific sampling and field screening methods, the definition of Maximum Extent Practicable, what to do about application sampling requirements in the face of drought conditions, and how to classify industrial parks as issues that lacked clarity. Further, participants felt there were some aspects where there was room for interpretation. Important to them was knowing where they would have latitude to make interpretations.

Presented here are the areas commonly identified as in need of clarification by EPA.

a. **Who is covered under the industrial SIC codes:**

Every group questioned EPA's use of the Standard Industrial Classification codes to determine which industries should be included under the regulations. The consensus was that these codes, which are economic indicators, are inappropriate for regulations that deal with environmental issues. Their use has caused a great deal of confusion as various industries try to apply them to their "primary" activities. Businesses don't know how to use them to determine if they are included under the regulations - and regulatory agencies are very reluctant to make that call for them given the "downside" of either decision. Group members indicated that the Transportation category (#8) and the category of Exposure (#11) were the most problematic and inconsistent.

One state representative said that trying to get businesses past this first decision point had consumed most of the manpower in their office. They were receiving 80-90 phone calls a day just on that question; they had to hire a "temp" to respond to these phone calls and refer callers either to an EPA field office or a consultant. Another group member said that they did one informational mailing to businesses in their county, and were flooded

with 7,000 phone calls; they did not know how to respond to callers, so they ended up hiring a consultant to handle the questions.

One comment from a member in the Phoenix group accurately represents the feeling expressed across focus groups: "It is virtually impossible to determine who needs a permit...You are not looking at the runoff quality with the SIC codes. I do not know of an existing code that looks at runoff, and that ought to be the basis of the code (used for these regulations)."

EPA needs to clarify how these codes are to be used. As one member stated, "OMB decided to use the SIC codes for other than they were intended. EPA (therefore) must define how to use it; this needs research and an environmental interpretation done." EPA also needs to be explicit about states' liability if their interpretations of coverage are different from what EPA's would have been. One group member suggested that EPA put together a brief (1-2 page) guidance summary to help industries decide whether they are covered, and also to develop descriptive categories of industries covered. EPA needs to define the minimum criteria for coverage to help regulatory agencies and industries determine their status, and then give latitude to states to use Best Professional Judgment when making decisions to include or exclude a given industry.

b. Exposure:

The category of "exposure" was cited by all groups as one of the two most difficult to determine. Members requested that EPA allow regulatory agencies to use Best Professional Judgment in determining which industries should be covered. Examples were mentioned, included the artist doing metal sculptures (all his activities took place indoors), and the farmer trucking potatoes to the potato chip factory (he was advised to cover his load with a tarp). As one member stated, decisions on whether an industry falls under the exposure category need to be determined on a case-by-case basis, and may require a site visit for a final decision to be made. Members did feel this category was "good" because it is the only one that is risk-based, yet "bad" primarily because exposure is "fuzzy".

EPA needs to allow states to develop their own definition and criteria for exposure, reach agreement with them, and be comfortable with the possibility that states may be different. The enormous number of covered industries under the category would otherwise exhaust EPA's resources to deal with it.

c. **The group application process**:

Focus group members feel that the group application process has created significant confusion among permittees; there is no such thing as a group permit, yet there are large numbers of industries that participated in a group application still under the impression that they will be covered by a group permit. As a number of participants stated, "(those who applied for one) think group applications mean group permits. And that is not the case."

One industrial member voiced their frustration: "Industry feels that the group application was misrepresented. (We thought,) this looks good; we can band together, demonstrate our likeness, devise sampling techniques, and regulate accordingly. Then we heard that you don't get a group permit; you get sent to the next tier down - the state. And the state then decides what you get... This has discouraged us from being proactive, forward thinking, because the rules keep changing in mid-stream."

Some members thought the group application was a useful process. One stated, "The group application process will get the best information at the least cost. It is the best research process because you can control it. For example, the textile industry: consultants will get together with them to determine how sampling and BMPs will be done. It provides a source of comparison within industry."

EPA needs to let participating industries know what the process is about, what the next steps will be for them after application review, and where there will be extended timeframes for them to submit a NOI under a general permit or an individual permit application.

6. **EPA needs to consider consolidating programs in order to address water pollution in an efficient and cost-effective manner.**

All groups suggested that EPA look at consolidating the different water programs for greater cost-efficiency and effectiveness. Rather than looking at it by different water source, e.g., storm water, wastewater, wetlands, etc., limited federal resources could be applied on a prioritized basis by watershed. Group members felt that this approach would eliminate redundant efforts across programs, allow dollars to be spent by risk priority rather than through separate program allocation, and have a more profound effect on reducing water pollution.

The perception is that present programs are more interested in "bean counting"; that is, keeping their present funding levels at the expense of the environment. One group member said, "Avoid bean counting...Transfer the funds to where it makes sense. Some water bodies have five different funding streams. (EPA)

should look at one water body, and look at point and non-point factors. See if we can pull the program together to yield an environmentally efficient program that brings all this together. This would form a prototype of pollution elimination by integration of programs." Another suggested the development of a "water pollution block grant."

In no group was there a concrete discussion on how EPA would accomplish this at a federal level, although many thought that a start would be to get people from each of the programs to "sit down together in the same room" to discuss ways of working together toward the same goals. State representatives were aware of program separation at their level, and cited the different funding streams - with some programs having far more than others - available for each one. It is clear that most would like to see a strategy in place that allows monies to be allocated based upon watershed priority. This ability to be able to shift funds between programs many felt would have eased the financial burden of getting their storm water programs up and running.

7. EPA should continue to focus on general permits in order to get the program implemented as efficiently as possible.

One of the most-mentioned ways of reducing regulatory burden was the use of general permits to cover as many industries as possible. Many state participants voiced frustration at EPA's slowness in getting a model general permit out, and some remarked on their slowness in reviewing state applications for general permit authority. One indicated that it had taken their state nine months for approval. Yet groups were unanimous that general permits are an excellent way to streamline the program.

Participants felt that states should **want** permit authority; as one member put it, "...they should want control over their own destiny." States that have not applied for general permit authority, such as New York, are seen by permit applicants as unhelpful. One voiced frustration that his state DEC office could not provide assistance when he needed it, because the state had chosen to "ignore" the regulations; he has looked to the regional EPA office for assistance, even though he was not sure that was the "right" route for him to go. Another state representative said that her state wants authority because "they could then issue more permits, cover more people. It's revenue-producing, and the dollars would come into (our) department."

Many participants predicted that states without general permit authority will be overwhelmed by the number of individual permits. They felt that EPA, as well as state and national trade associations, should make states aware of the consequences of not having general permit authority. One suggestion often heard was to get trade associations involved in lobbying state legislatures to put pressure

on their state government. Some members recommended that EPA also put pressure on states to apply for permit authority by using a carrot-stick approach: assist them to apply, but withhold program monies from non-delegated states. Others suggested that the carrot be dollars, such as the 106 monies, used as an incentive. Participants felt that getting most industries into the program under a general permit umbrella would establish a baseline for the program so that a tiered approach could be used to identify and deal with pollutant sources.

It was evident from comments that some state representatives would like to see a model general permit. They are looking for guidance in developing their own, and models--either EPA-generated or state-generated--would obviously assist states in drafting their own. Critical to this effort is that this assistance be made available as quickly as possible.

There is a common thread across these seven issues. That thread is the need for more and clearer communication, from use of terminology and language more familiar to the "layperson", to explicit guidance on fund raising approaches to support program implementation.

In many organizations, "improved communication" is cited as a sought-after end, but it is often set forth without identification of the means by which to achieve it. With this project, EPA addressed the means by asking the "experts"--those people at the regional, state and local levels who have to ensure that the regulations are implemented--where communication has faltered and what is needed to address the problem. It will be the continued involvement of these people in working on solutions that will ensure successful achievement of the end.

PART II: DESIGNING PHASE II OF THE STORM WATER PROGRAM

The second part of The Rensselaerville Institute project was conducted during April-September 1992. It consisted of three distinct efforts: a survey of point source and nonpoint source program experts to gain their insights on the development of a strategy for Phase II of the storm water program; three public meetings to gain citizen advice on key elements that should be considered for the Phase II program; and facilitation of a "design team" effort with selected experts to generate a detailed strategy to guide EPA in planning and implementing Phase II of the storm water program.

For each effort, the focus was on three elements: **targeting** (which sources shall be included and by what categories); **control** (e.g., should permits be used or another strategy developed); and **timetable** (with what schedule and over what period of time should Phase II be implemented, particularly with regard to the October 1, 1992 deadline established in the Clean Water Act amendment).

This report profiles project activities, then summarizes the findings from each of them. The reader is referred to the supporting documentation in Volume II of this report for the database compiled during this project, including analysis and comments from the Expert Survey.

Expert Survey

Part II of the project began with survey input from a select group of 32 storm water experts from throughout the country. Five perspectives were represented: academic/research; commercial development; consultant engineering/legal; environmental advocacy; and state/local government. A Delphi-type survey approach was used to obtain initial opinion and consensus on relevant issues and options for addressing Phase II sources.

Two survey rounds were conducted with point source program experts. The instruments presented respondents with a series of potential targeting and control strategies along with timing options. Survey participants were asked to identify the strengths and weaknesses as well as steps and resources needed to implement each option and were also given the chance to suggest an alternative strategy to the ones presented.

Five nonpoint program experts received one survey designed to capture more specific information on voluntary approaches for achieving program success. They were asked to provide the same level of detail for their preferred strategy as point source experts. Please see Volume II of this report for survey transcripts and analyses.

Survey Findings

Respondents were asked to identify, from a list of 18 potential sources, which sources they felt to be the top five that "must be" regulated in Phase II. In descending order with frequency of response in parentheses, the sources identified were:

1. "Some industrial activities not covered under Phase I because of anomalies in the SIC codes." (24)

2. "Suburban areas of large metro areas outside city boundaries." (20)

3. "Some commercial activities with industrial components." (18)

4. "Large retail complexes." (15)

5. "State highway systems." (13)

The themes that characterized the designation of these sources as the top five included: 1) contribution to pollution load; 2) risk posed; 3) administrative efficiency of control; and 4) cost-effectiveness of control.

Respondents were presented with specific strategies for targeting and controlling Phase II storm water sources. They were asked to assign a level of desirability and feasibility to each. The scale used ranged from "1" (least desirable, least feasible) to "7" (most

desirable, most feasible).

The three targeting strategies, and ratings and comments they received, are listed below.

Responses to Strategy I were spread across the scale; 39% of respondents felt it was "very desirable" and 36% rated it "not desirable". The same response pattern was given to feasibility: 21% rated it highly feasible while 29% rated it not feasible. That strategy was:

Strategy I: "Eliminate Phase II as a separate part of the storm water program and expand the current designation authority under Section 402 (p)(2)(e)."*

> *** 402(p)(2)(e): A discharge for which the Administrator or the State, as the case may be, determines that the storm water discharge contributes to a violation of a water quality standard or is a significant contributor of pollutants to waters of the United States.**

Some of the comments made by experts regarding this strategy included:

- "Gives the Administrator too much authority."
- "This approach provides the greatest flexibility and provides time so that we can learn from current programs."
- "Not feasible...unfortunately, the science is often not good enough to pinpoint culprits; the database...is weak; it is difficult to single out one of many candidate polluters."
- "Allows resources to be focused strictly on problem sources from the Phase II universe."
- "Arbitrary and capricious interpretation of intent of Congress."
- "Very desirable and feasible. It makes sense to target programs to areas that contribute to water quality standard violations and are significant contributors of pollutants."

Responses to Strategy I were the most mixed. While some saw it desirable because sources covered would be more selective and limited and therefore the program would require less resources and administration to implement, others did not support it because they were unsure what criteria would be used for targeting sources, and were concerned about the types of information used in decision-making as well as the experience of those making the decisions.

Most respondents felt that Strategy II would be costly, complex and unwieldy, and resemble Phase I in terms of its drain on resources and manpower. Some respondents felt it would expand the number of groups opposing storm water regulations.

Strategy II: "Cover all remaining point source storm water discharges under existing Phase I requirements."

This strategy received a mean rating for desirability of 2.25 and a mean rating of feasibility of 2.43.

Some of the comments regarding this strategy included:

- "Inadequate resources would pose a major implementation problem."
- "Ill advised and will be increasingly costly. There is no need to promulgate new regulations that we know will not be enforced."
- "Would be an administrative nightmare."
- "Too broad with respect to potential benefits."

Strategy III was seen by a majority of respondents to be the most equitable and rational of the three choices, as well as the most scientifically based. Concern that political pressures might sway the development of targeting criteria was expressed by some respondents. That strategy is:

Strategy III: "Apply Phase II controls selectively (e.g. on the basis of such factors as population density, pollutant loadings, or geographic targeting, or others you find to be appropriate)."

This strategy received a mean rating for desirability of 4.64 and a mean rating of feasibility of 3.75. It was rated the most desirable and feasible of the three suggested strategies.

Some expert comments on this strategy were:

- "Best of all worlds - reasonably objective."
- "Strategy III is the most desirable of the three strategies because it maximizes efficiency, effectiveness, and the flexibility to address water pollution problems based on site-specific factors, especially risk."
- "Sound on a technical basis, but probably requires too many resources, particularly information needed to do intelligent targeting."

- "Desirable - this focuses scarce resources on likely and easily identifiable problem areas. Feasible - the factors (e.g. population density) are easily identifiable."

In the second round of surveys, respondents were asked to recommend a fourth strategy if they did not support one of the three suggested by EPA. Most frequently mentioned was a strategy that was **a combination of Strategies I and III.**

Four control strategies were presented to respondents for similar ratings of desirability and feasibility. These strategies were:

1. **"Mandatory reliance on general permits."**

2. **"Direct regulation under a national Phase II guideline, which may well require a national rulemaking by EPA."**

3. **"Requiring direct regulation of Phase II municipalities under 100,000 and requiring them to develop necessary controls for priority sources discharging into the municipal storm water system."**

4. **"Control under the nonpoint source program authorized under Section 319 of the Clean Water Act."**

Desirability ratings for the first three strategies were approximately the same: respondents felt that they were "somewhat" desirable. The fourth strategy was rated as slightly less desirable. The greatest feasibility was assigned to Strategy 1. The least feasible strategy, in the respondents' opinions, was Strategy 4.

In the second survey round, respondents were asked to describe implementation of their preferred strategy. When asked what minimum control strategies they would use, the following methods were mentioned:

- a menu or roster of BMPs from which could be selected the most appropriate approaches for the industry or watershed;

- public education;

- erosion and sediment control methods;

- "good housekeeping" and source reduction/elimination methods;

- establishment of national minimum standards;

- elimination of illicit connections;

- emphasis on pollution prevention.

Few respondents saw the implementation of Phase II to be a short-term process. Most suggested a phase-in approach over a period of five to ten years. During this time, BMPs could be tested for effectiveness and cost-benefit in terms of reducing and eliminating storm water pollutant problems, and programs could establish solid components of education, training and technical assistance.

Nonpoint Source Perspectives

Nonpoint program experts also favored Strategy III: "Apply Phase II controls selectively..." for targeting Phase II sources, with a mean rating of 4.0 on Desirability. The ratings ranged, however, from "1" (not desirable) to "6" (very desirable). Some of the comments included:

- "Is inequitable. Establishes economic hardships for those required to participate. Only strength is less administrative burden."

- "Would be easy to identify sources that fall under criteria. Could be preventive since you are not waiting for a problem to happen."

- "Excellent in theory, but would require a lot of data for prioritization, and would create confusion for some period of time."

The survey instrument used for nonpoint program experts was a modified version of the point source expert survey that included a fourth EPA-suggestedtargeting strategy for consideration. It was:

Strategy IV: "Target and address problems and significant storm water sources and pollutant loadings by using Section 319 and CZARA programs."

Respondents' mean ratings of the strategy were 3.2 for desirability and 2.8 for feasibility. Comments included:

- "These programs lack real regulatory teeth. CZARA 6217 applies only to coastal regions. They just aren't aggressive enough."

- "Section 319 is broader than NPDES and has more technical experience with BMPs. CZARA 6217 results in specification by EPA of management measures, in effect setting standards and providing impetus to explore alternatives."

- "Since only limited 319 funds are available, it would be difficult to get much done."

- "This is an important piece of a multifaceted approach, but not adequate alone."

Respondents were given the same control strategies for consideration as the point source program experts. Of the four, #3: "Requiring direct regulation of Phase II municipalities under 100,000..." was most favored, with a mean rating of 5.2 for desirability and 3.8 for feasibility. This control strategy was the only one to receive ratings higher than "5" for either desirability or feasibility.

The majority of respondents were opposed to extending the October 1, 1992 deadline. The reasons given included:

- "The longer we wait to address the problem, the more costly, less technically capable and less environmentally effective the solution will be. There are more opportunities today, especially in less populated areas, than tomorrow to solve and prevent problems."

- "Storm water-related use impairment is a serious problem. Currently, there is little being done to remediate existing problems and no assurance that problems related to new development will be prevented. It is clear that the voluntary approach is not adequate."

- "Things aren't getting better. Forum and impetus are already in place - capitalize on it."

Many of the recommendations made by point source program experts for targeting and controlling storm water sources were echoed by nonpoint survey respondents. Some of the targeting similarities include:

- selection of Strategy III: "Apply Phase II controls selectively..." as the most desirable of EPA-suggested strategies. The most mentioned reasons for preference were ease of identifying targeted sources, and the more efficient use of resources;

- target by watershed impairment/threat severity;

- conduct pilot projects first, evaluate, and then develop and implement a strategy;

- develop minimum national guidelines, and leave selection of sites and methods to state discretion;

- initiate a focused dialogue with key stakeholders (for both targeting and controls).

Some of the similarities in preferred control strategies included:

- build a BMP menu that can be used to implement and verify progress; allow selection of most appropriate BMPs based on industry and watershed;
- provide public education on need for storm water control;
- provide national criteria with flexibility for local implementation of most appropriate controls;
- develop baseline control standards for all new development.

One primary difference between point and nonpoint respondents was the application of the "stick" by EPA, with the "stick" being the requirement of permits for those sources that did not achieve significant movement toward program goals via voluntary efforts within a reasonable timeframe. As one nonpoint respondent phrased it, EPA should keep permit requirements as the "gorilla in the closet" to be used as needed when voluntary efforts were not adequate for the problem.

A number of nonpoint respondents indicated that the 319 and CZARA 6217 programs do not have the "teeth" they need to ensure compliance. Most feel that a combination of programs is needed for successful achievement of water quality goals.

EPA STORM WATER PUBLIC MEETINGS

Description of the Meeting Format:

Three public meetings were conducted to gain citizen suggestions on options for targeting and controlling Phase II sources. These meetings were held in Denver, CO; San Francisco, CA; and Washington, DC. Approximately 200 people attended the three meetings.

At each meeting, three experts selected from the survey process presented their ideas on a regulating strategy for the moratorium sources. Following their presentations, attendees were divided into small task teams with an assigned facilitator, and given the charge of devising their own strategies for targeting and controlling Phase II sources. The strategy template provided to guide group consideration of key issues is presented below. During the latter half of the meeting, each task team presented their option to the other attendees for discussion.

Teams were asked to consider these issues:

1. Targeting (What light industrial, commercial, retail, residential, or other areas or other areas do you include in Phase II?)

2. Control (Do you use continued reliance on the existing NPDES permitting process or something else such as nonpoint source programs, selected permitting based on risk, geographic targeting, etc.?)

3. Timetable (How would you phase in the major components of the strategy and over what timeframe? Do you suggest full implementation on October 1, 1992 [as stated in CWA] or do you recommend a different set of deadlines and why?)

4. Key steps to implement (Please indicate up to five critical, major steps to take in implementing your strategy and the timetable for each.)

5. How will costs of your strategy be distributed over key players and how will costs be understood and controlled?

6. What measures of performance will you use and how will you verify the environmental results? (Do you rely on numerical measures and quantitative pollution indices or other factors?)

7. Strategy Strengths (Name four key strengths of your strategy which, in your judgement, make it preferable over alternative strategies.)

8. Strategy Vulnerabilities (Name four most critical points at which your strategy is most vulnerable to failure or shortfall in implementation.)

9. For whatever strategy is chosen, what could EPA do to make the decision-making process for Phase II more responsive?

Meeting Findings:

A total of sixteen task teams presented their strategies for Phase II of the storm water program. The individual task team strategy outlines offered a diversity of approaches for designing, implementing, monitoring, and funding Phase II of the storm water program. Individual strategies presented a large range of methods for targeting and controlling sources, and many different timeframes over which the program could be phased in.

Despite the different representations, experiences and expertise, there were points of congruence between many of the proposed strategies. Common strategy characteristics across task teams included the following:

1. **Targeting:**

a. Targeting should be done by watershed. Information gathered from Phase I should help identify sensitive watersheds. May require intergovernmental agreements.

b. The focus should be on "bad actors", i.e. those that are known problem sources. The ones most frequently identified were: gas/auto service industries, transportation, highway systems, land development and agricultural sources. There needs to be the ability for facilities not contributing impairment of water to gain an exemption from permits, fees, implementation of BMPs. Categories are an ineffective way to designate covered sources. Selection should be done by the degree of risk a given facility poses rather than categorical inclusion.

c. Small municipalities should have a much simpler application process, or have the opportunity to be excluded if they do not contribute to the pollution problem. In addition to impact on a watershed, proximity to larger municipalities should be considered as well.

d. EPA should defer on selecting targeted sources until the agency has carefully looked at the data gathered during Phase I. Numerous sources of information are available which would help determine targeting priorities, e.g. information gathered through 305b reports, information from Phase I program sources, NURP.

2. **Controls:**

a. If a permitting process is to be continued for point sources, NPDES general permits should be used, and focus should be on BMPs. Permits should be simpler, and much less costly. EPA should make clearer to the applicant what information is required, e.g. checklist of inclusions, menu of BMPs. Exemptions should be available for non-contributors.

b. Education should be a primary form of control. It is important at all levels and for all audiences, yet is often overlooked or underrated.

c. There should be more emphasis on voluntary programs, e.g. the "319" nonpoint source program. For facilities with contact with storm water, there should be little or no more government intervention, but rather emphasis on pollution prevention incentives, BMPs, and practical measures of pollution prevention.

Pollution prevention programs should be emphasized, particularly with new

development. Some suggested prevention methods include: recycling storm water, good housekeeping practices, plantings to minimize runoff, street sweeping of work areas on a daily basis, storm water collection methods, coverage of storage areas, changing manufacturing processes to minimize pollutants, improvement of air emissions.

d. BMPs should be required based upon the specific pollutant problem and strategies known to be effective in its mitigation or elimination. The focus must be a known connection between solution and its effect on the problem. BMPs must also recognize financial constraints, providing actions that are relatively higher in terms of cost-effectiveness.

3. Timetable:

a. A minimum of two years is needed to prepare for Phase II, with at least a year dedicated to looking at data gained from Phase I of the storm water program. Effectiveness of presently used BMPs needs to be looked at to determine differences in effectiveness between geographic locations and pollutants.

b. Whatever the period established for phase-in, it should not begin <u>until</u> promulgation of the regulations.

4. Role of EPA Headquarters.

a. Research, information dissemination, technical assistance.
EPA should also provide focus within these areas. Also, the current efforts are too diffuse, and imply a complexity that makes applications seem difficult and formidable.

b. Funding, not for program implementation, but for research.
Two areas of research requested are water basin pollution control and determination of effectiveness of BMPs. The majority of participants recognize that EPA does not have the fiscal resources to fund programs. What they <u>do</u> want from EPA is guidance in establishing fund raising mechanisms, such as storm water utilities.

c. Establishing broad guidelines for the program within which local flexibility is allowed and encouraged.
Flexibility, at the same time, does not provide an excuse for inaction or postponement. Rather, it recognizes that different actions and action sequences are appropriate to different contexts and conditions.

d. Responsibility for training regulators in the storm water program.

Until those administering the program are well equipped to enable action, effective responses will be difficult.

Please see Volume II of this report for copies of the individual strategies developed at each of the public meetings.

Reflections on Meeting Format

A presumption shared by EPA and the contractor, The Rensselaerville Institute, was that the conventional format for public hearings and meetings is of limited value in engaging citizens or of making the critical transition from criticism to advice on how best to do things. Given this belief, a different format was devised that proved quite different from the typical approach of lectures by experts and/or testimonies read to the record by concerned citizens.

In the interactive approach used, participants were advised that they would be asked to form into task teams to first listen to experts offer their insights, then to develop, as a team, a preferred strategy for responding to Phase II of the storm water program. Each team comprised a cross-section of those attending--including where there are possible strong environmental, industrial, and local government perspectives.

In all three meetings, participants accepted the format and energetically engaged in the task of constructing a preferred solution. This included the session held in Washington, D.C. where participants from major interest groups were in the habit of providing critical feedback and criticism more than engaging in a positive design process.

To gauge participant responses to the different public meeting format, a mail-back questionnaire was used inviting comments by the some two hundred participants in the three public meetings. Approximately 35% of those attending completed the survey. They were first asked to comment on their assessment of the more traditional public hearing format. Most held a clear and consistent view of the traditional approach as focusing primarily on prepared statements. Where dialogue was included, it was seen as argumentative and contentious. The general conclusions:

- opinions are solicited for the record and to insure the perception of public participation but not to provide genuine input. The sense is not of active government listening.

- primary participants are those with strong convictions and often special interests; they are not a representative sampling of public opinion and tend to run the gamut of extreme perspectives on a given issue.

- sessions tend to become adversarial or at best argumentative. No mechanism for cooperation is available and differences tend to get

magnified, not resolved.

- the focus is on the problem much more than on ideas for resolving it. On the one hand this attracts critics more than implementors. On the other, it provides little guidance to people who full well know the problem and are looking for ways to deal with it.

Participants were much more positive about the format used. Among the sentiments voiced:

1. Participants had a full chance to participate--not only to be heard but to be directly engaged in finding solutions.

   "It was a valuable way to address the drafting of regulations--allowing the regulated community to feel part of the process";

   "Encouraged the regulated community to get involved <u>and feel</u> involved";

   "Participants felt that EPA was actually listening and dialoguing."

2. The process was genuinely two-way, allowing both EPA staff and those effected to better understand each other.

   "It made you appreciate the USEPA's tough job of satisfying the concerns of many people while protecting the environment";

   "Felt it draws out better data";

   "Actually got to <u>interact</u> one on one with industry and government and consultant representatives. Obtained a better point of view of government's problems and felt that government representatives also obtained a better point of view of industry's problems."

3. The format created an atmosphere for cooperation and even for collaboration among people with very different viewpoints.

   "The meeting went a long way towards promoting the creative thinking, open discussion, and presentation of ideas";

   "Group discussion is a fine vehicle to provide input as well as learning tool. It forces you to think through participation, rather than just simply sitting and trying to absorb by osmosis.";

"Small diverse groups allowed ideas to be evaluated fairly and fostered "brainstorming" and allowed ideas to be developed to better fit broad based objectives."

The positive elements of the meeting extended beyond the effective communication of opinion and position to EPA to broader understandings of issues, complexities, and solutions. Indeed, the sessions seemed as influential in creating new insights as in communicating old ones.

Respondents suggested two primary ways to improve the format for future uses. The first is the need for more detailed advance preparation--in part, needed to change the mind-set and expectations which people tend to have for a traditional public hearing or meeting. The second suggestion: minimize expert presentations, even when used in the "pump-priming" mode employed in this session. Trust the process and get right to the participants.

When asked if they would advise the EPA to use this kind of interactive task-focussed approach with other meetings designed to get public input, over 90% said "Yes." Two persons indicated that it depends on the issue and only two indicated that they preferred to remain more passive.

THE "DESIGN TEAM" MEETING

Meeting Description:

A meeting of seven point and non-point storm water program experts, all of whom were survey respondents, and selected EPA staff was convened in Washington, D.C. on September 17-18, 1992. The purpose was to gain the experts' insights on development of Phase II storm water regulations, and the intended outcome was to build a strategy, or multiple strategies, for regulating Phase II sources.

Participants included:

Mr. Gail Boyd
Woodward-Clyde Consultants, Portland, Oregon

Ms. Diane Cameron
Natural Resources Defense Council, Washington, D.C.

Mr. Dennis Dreher
Northeastern Illinois Planning Commission

Mr. Tom Mumley
San Francisco Bay Regional Water Quality Control Board

Mr. Earl Shaver
State of Delaware Department of Natural Resources and Environmental Control

Ms. Coleen Sullins
State of North Carolina Division of Environmental Management

The participants selected were deemed, by their peers nationwide and EPA, insightful and highly articulate exponents of all major viewpoints on the storm water program.

Also in attendance were these key people from U.S. EPA:

Mr. Michael Cook, Director
U.S. EPA, Office of Wastewater Enforcement and Compliance

Mr. Geoffrey Grubbs, Director
Assessment and Watershed Protection Div.
U.S. EPA, Office of Wetlands, Oceans and Watersheds

Mr. James Horne, Special Assistant to the Director
U.S. EPA, Office of Wastewater Enforcement and Compliance

Mr. Ephraim King, Chief
NPDES Program Branch, Permits Div.
U.S. EPA, Office of Wastewater Enforcement and Compliance

Mr. Jack Lehman, Deputy Director
U.S. EPA, Office of Wastewater Enforcement and Compliance

Session Findings:

1. Development of a ten-point outline describing a potential strategy for Phase II of the storm water program.

Consistent with the overall purpose of the meeting, participants identified ten core elements that they feel constitute a potential strategy for Phase II of the storm water program. These elements are:

A. Objective: To get certain BMPs, ordinances and education programs into place over a 10-15 year period. Progress would be measured by getting these elements into place, with direction toward water quality standards and beneficial uses over a longer period of time. EPA would work with all states to help them develop Phase II programs.

B. Priorities: EPA would set these. They would include: the sources listed by the group, using a watershed approach where feasible, focusing first on those local governments with the size and capability to get going.

C. Education/outreach/technical assistance: these are all critical components of a successful program.

E. Mandatory Interim Milestones: EPA needs to determine interim milestones state programs need to meet which would show they are on track.

F. Financial Plan: states/local governments need to develop plans for financing the program.

G. Guidance: guidance is needed on BMPs and local ordinances. These would be generated at the federal level, and states could adapt/modify as needed.

H. "Default" system: local governments would take the lead with their programs, but there would be a built-in default system where the states or EPA would take over with more stringent controls if the locals fail to meet requirements.

I. Permit issuance: for high priority categories, could issue permits that allow flexibility or some alternative mechanism at state's option. Permits might be just for high priority categories; would include site design performance standards.

J. Phasing: there would be a schedule for issuing permits to key municipalities: high priority to low (e.g. coordinate by watershed); high flexibility to "getting tough" with recalcitrant localities. These would be based on inspections, on-site reviews.

K. Monitoring: this would be the difficult part of the program because of cost. Need is to be able to design something useful. The system might be "tiered" - highest to lowest priority; or "strategic" - focused only on gathering what we really need to know.

2. Sources to be targeted in Phase II.

The participants identified a number of specific unregulated pollutant sources that need to be targeted in Phase II of the storm water program. An approach recommended by some of the participants for controlling these sources is a "whole basin approach", which would focus attention and resources on activities impacting the water quality of a given watershed.

The group identified approximately 40 pollutant sources that they believe need to be included in Phase II of the storm water program. The sources identified include the following:

New Development/Redevelopment (commercial and residential)
Transportation Corridors
Dense Existing Development (commercial and residential)
Automotive Services
Federal facilities/military facilities
Feedlots (including dairy)
Failing septic systems
All incorporated places with less than 100,000
Non-urbanized watersheds yet to be determined
Parts of watersheds where land use is in a state of flux
Dry cleaning shops
Parking lots
Some forest operations
Nurseries/orchards
Recreational areas (e.g., stadiums, golf courses)
Landfills
Office parks
Grain elevators
Concrete cutting sites
Commercial pesticides
Landscaping industry
Car washes
Mobile washing units
Equipment maintenance
Boat yards
Tank farms
Shopping malls
Restaurants
Airports
Janitorial services
On-site solid waste (collection, hauling, transfer stations)
Atmospheric deposition
Cemeteries
Commercial strips
Wood stoves
Marine ports
Animal waste
Warehouses/storage facilities
Exterior building maintenance
Bridge maintenance

Members of the group suggested that rather than use the Phase I approach of including sources by category into the regulations, regulatory staff time and resources should be allocated on a water basin approach, i.e., target a watershed, identify impacting activities and their location within the watershed, and determine a set of criteria to deal with the problems impairing the watershed. This would allow limited resources to have maximum impact.

3. Source priorities.

After listing the range of sources that they felt should be included in the Phase II program, participants voted for what they considered to be the top priority sources, i.e. those sources that EPA should address immediately and diligently. The top sources selected are listed below, in order of decreasing number of votes received. All sources were selected by at least 50% of the participants. The sources identified as top priority for addressing in this order:

A. New Development/Redevelopment (commercial and residential)

B. Transportation Corridors

C. Dense Existing Development (commercial and residential)

D. Automotive Services

E. Federal facilities/military facilities

F. Feedlots (including dairy)

G. Failing septic systems

4. Lessons from a case study.

One participant presented an outline of the basic components of the Puget Sound Water Quality Management program. The program is a multifaceted approach toward the achievement of improved water quality which heavily emphasizes voluntary measures in its implementation strategy.

The program includes minimum BMP standards for all jurisdictions with additional water quality treatment BMPs, guidance and requirements for higher risk storm water dischargers. Key facets include: vigorous technical assistance, education, state financial support, education and support for storm water utility development, highway runoff regulations, a full nonpoint watershed management program, storm water operation and maintenance requirements, source controls, and local control and flexibility.

The program is being phased in over several years. It is a combination of mandatory requirements, technical guidance and voluntary compliance. There are specialized focus areas, such as shellfish protection districts and conservation districts. There is a coordination effort with individual and general permittees in the Puget Sound area.

The program views its strengths to be greater local flexibility and acceptance of requirements, a strong sense of teamwork between all levels, better water quality results, and better targeting and use of limited resources than if they were regulated by NPDES. They view the NPDES program as the "gorilla in the closet" that can be brought to bear if and when a source does not meet minimum standards and requirements.

5. Principles for Phase II.

Participants discussed the basic principles they believed should drive the Phase II program at the national level. For the program to be successful, it would require that the following pieces be put into place:

A. Require that people gather documentation of information regarding dischargers' activities and accomplishments and provide outsiders with that documentation;

B. Formally define gaps where additional information and understanding is needed. There needs to be an incentive to close these gaps;

C. Support (with encouragement and incentives) efforts that will close these gaps, and advance the state of the art and/or provide a technically sound basis for the programs' requirements;

D. Actively encourage a broad spectrum of understanding and involvement (the general public, community leaders, service groups, environmental groups) via educational programs and materials;

E. Strategically identify "good" guys and "bad" guys in the regulated community;

F. Provide clear guidance regarding programmatic and physical actions that are required/expected. Actively seek out evidence that people know <u>what</u> to do, and provide technical training to be sure that people know <u>how to do</u> what is required (technical transfer);

G. Require relevant/credible/useful monitoring only. Don't waste people's time/money/energy running data collection programs that yield bad or irrelevant data.

6. State suggestions of what EPA needs to consider in developing the Phase II program.

A sub-group of participants from state regulatory agencies met, and set forth a list of suggestions for EPA to consider in developing Phase II. The following recommendations were made:

A. EPA needs to provide states with the minimum program requirements they must achieve, and then allow states flexibility on how they will do it. The components must include:

- requirements/BMP standards for new development
- education/technical assistance
- control requirements for illicit connections/dumping
- developing state-specific priorities

B. EPA should require states to adopt regulations that specify program components that must be included;

C. To assure program funding, EPA needs to require that state and local governments set up funding mechanisms, e.g. storm water utilities, permit fees, etc.;

D. EPA needs to compile and disseminate technical information that would support programs, e.g. set up a national or regional clearinghouse of information on storm water plans being implemented, BMP-specific information and materials, etc.;

E. EPA needs to compile a national BMP manual that would assist members of the regulated community in determining and implementing appropriate BMPs to address their storm water problems. EPA needs to recognize, however, that BMP application will differ between regions, e.g. climatic differences will require different approaches;

F. EPA needs to require that states develop and implement education, technical assistance, and training programs; EPA also needs to hold the states responsible for effectiveness of these programs, and require permitting in the event that these measures do not work;

G. EPA needs to maintain the right to require permits in a reasonable amount of time (e.g. 2-3 years) if a state's program is not meeting federally determined requirements;

H. EPA needs to determine what short and long term goals they wish the

storm water program to achieve.

7. Identification of problem areas and needs of the regulated community in dealing with the storm water program.

Participants were asked to identify what their "hot buttons" were, i.e. elements or considerations that EPA might include in the Phase II program which would cause major problems for them, or those which if not considered by EPA would create needs for the regulated community.

The list of "hot buttons" include the following:

A. Penalizing those who have already solved their problems by requiring permits.

B. Liability for water quality standards, sediment standards, and resource damage clean-up in the first round.

C. Failure to provide technical transfer - permittees need to know what to do and how to do it.

D. Failure to promulgate revised and simplified NPDES regulations that get around the complicated approval process.

E. Possible backlash from local governments if they are held responsible for instances of independent commercial activity that they cannot address or control when they don't know about it.

F. Lack of research on BMP effectiveness from a watershed perspective. There is inadequate federal/state money to look at BMPs because monitoring is so expensive.

G. Possibility of EPA <u>not</u> basing the program on permits (except in cases where the state can show that it can reach goals alternatively).

H. The inherent substantial risk of tremendous backlash that would affect people's livelihoods, i.e. failure to try to sell the program to regulators and public, including the NPDES permit process.

I. Prevention v. wetlands - determining how to prevent storm water problems while protecting wetlands.

J. Not addressing the roadblocks created by the regulations themselves. The system is so complicated, it now takes two generations for permits to get

to goals.

K. Lack of federal monetary assistance. Some states may be reluctant to develop adequate programs without it.

L. Not getting rid of the acronyms in the regulatory language. No one understands what EPA is saying.

M. Concern that mainstream design is end-of-pipe treatment. This is not prevention! CZARA is on a better track.

N. Allowing states to cut monitoring activities first. They need to be encouraged to not eliminate that element disproportionately from their budget.

O. Need to figure out how to sell the program - to get through to OMB and top levels of state governments exactly what it is going to take to get the program into place.

P. Not identifying funding incentives and disincentives.

Q. Not giving praise for progress.

Additional Advice

Additional suggestions for development of the Phase II program were generated by the group during the two-day meeting. Included in those recommendations are the following:

1. **EPA needs to revisit and revise the terminology used in the regulations.**

   - the problems are often with the common words, e.g. runoff, storm water, nonpoint source, point source. EPA staff have attached certain meanings to words that are not conveyed to the regulated community, so there is inherent danger that people are not talking about the same thing. Words need to have clear and referenced meanings.

   - the enormous number of acronyms used by EPA creates significant comprehension problems for regulatees. The regulations need to be written with fewer acronyms, and all communications need to be sensitive to the level of use.

2. **EPA needs to clearly define the goals of the program.**

- all levels of feedback (focus group, survey, and meeting results) generated during The Rensselaerville Institute project have pointed out that the regulated community does not understand what EPA is trying to achieve with the storm water program. Assumption of what the goal is ranges from achievement of set water quality numerical limits to returning a water body to its original uses.

Confusion over the goals causes confusion for regulatees in terms of selecting the tools that need to be used to reach them. EPA needs to determine what the federal purpose is with regard to the storm water regulations given the reality of limitations of presently available methods and resources for preventing and treating storm water pollution.

3. **Citizen involvement can play an important role in achieving program goals. EPA, states and local governments need to promote citizen education and enforcement authority.**

Participants gave numerous examples of how citizens could play an active role in implementing and monitoring pollution reduction efforts. Given the limited resources of federal, state and local governments, voluntary citizen involvement can support successful program outcomes, including enforcement. Education of citizens at different levels, e.g. qualitative vs. quantitative monitoring, stream health vs. compliance monitoring, etc. would be needed. Guidance manuals can be developed to guide public education.

General Recommendations

The ten summary recommendations stated at the conclusion of the Executive Summary are here amplified to reflect the discussions and insights generated in this project. While not all persons involved agree with each observation and recommendation, these are advanced as having widespread support.

1. **It is possible and desirable to identify priority target areas for which there is widespread consensus concerning their contribution to water pollution.**

   These areas begin with new development and redevelopment--both residential and commercial. They also include transportation corridors, dense existing development and automotive services. Further, the priority of these target sources is relative to the watershed upon which they are impacting.

   Strategically, approaches that focus on a small number of priorities based on relative risk will show stronger results than one that initially targets a broad set of sources in Phase II. Also, it much more cost-effective to identify and pursue the "bad actors" (eg, those contributing toxicity as opposed to sediments or turbidity) as a priority, then get to those adding incremental pollution through routine activity.

2. **EPA needs to communicate more clearly and regularly with everyone impacted by the storm water regulations.**

The priority focus should be less on the amount of communication and more on different kinds of communication. Specifically, communications should be:

- more interactive--the examples of the focus groups and public meetings used in this project are often cited as productive formats for future citizen input;

- more localized to contexts--as in more regional workshops and fewer national ones. This means communications less inclined to reflect the national complexity of the program and more inclined toward addressing the specific information and guidance needs of the local person involved in a specific and delimited way. It also means less "canned" content and more consultative dialogue;

- less laden with acronyms and technical language that confuse and irritate many of the people who are the true "customers" of the program, and who are required to carry out the federal mandate. Along with this, more attention should be paid to finding and marketing simplicities rather than complexities.

3. **EPA could improve program effectiveness, efficiency and cost control in Phase II by "starting small".**

The concept of regional and even local prototypes was advanced by many people as a way of getting proposed new Phase II frameworks into the hands of users in prompt fashion to build and refine based on early use. This was generally seen as preferable to the comprehensive approach in which new programs are developed fully and then introduced comprehensively at a point when modification is difficult and expensive.

Related to prototypes is the case study--in which an analytical eye is turned to current programs that demonstrate one or more strategies or best practices for storm water implementation. An example is the Puget Sound model, with its focus on the tangible and cost-saving values of voluntary compliance by small businesses (a summary of this approach is contained in Volume 2).

The use of a small scale plays to the strength of regional differences as well as the reality that an equal stress on comprehensive large programs may so paralyze states and localities that nothing is done expeditiously.

4. **Selectivity in data collection and monitoring is essential.**

At present, some data collection frameworks consume tremendous time and money only to yield bad or useless data or murky or disputed conclusions. More attention should be paid as to what constitutes "good science" and activities that may show the appearance of effective activity but in reality be consuming scarce resources to no clear gain. This also relates to the adage, "what you measure is what you will get." While the tendency is to see monitoring and assessment as questions of methodology, they must first be viewed as questions of substance. What are we trying to measure and at what level of detail and accuracy?

Not all measuring and assessment need be arcane. In development projects, for example, the use of hay bales is known to contain overflows. No great study of cause or effect is needed. And if there is floating oil on a body of water, we can start by verifying that it is there--a useful step even if we do not "measure" its amount. At the same time, other kinds of assessment are meaningless without extensive (and expensive) levels of detail and analysis.

A related point is that documentation of discharger activity and accomplishment is as critical as scientific study of water conditions.

5. **More customer differentiation is also needed.**

At present the mind-set appears to be that one size fits all. While giving the appearance of equity, this concept actually creates strong inequalities. The same programs and regulations that befit a large corporation or municipality are simply not equitable for smaller enterprise and communities, for example. More broadly, some specific operations within a given source category contribute significant pollution; others contribute none. Some way to either make the initial process much less costly or to more quickly separate out those who do not need continuing attention must be found.

One form of general differentiation is between those who are causing a problem by clearly inappropriate activity (the "bad actors") and those contributing to storm water pollution by standard and at times inadvertent practice.

6. **While the ultimate goal is water quality standards, this is very difficult to achieve and/or to measure in the short term.**

While retaining water quality standards as the ultimate goal, EPA should be focusing on best management practices, and in particular those that reflect preventive and non-structural solutions. An example is stronger standards and technologies for storm water control in new residential and commercial construction. In many instances, the correlation is clear between the management practice and the consequences for cleaner water.

The codification and communication of best management practices applies not only to those targeted and controlled but to state and local actors implementing storm water programs. For example, a set of "carrots and sticks" known to promote voluntary compliance is just as critical to disseminate as a new approach to storm retention ponds in a sub-division.

While BMPs are set in place, interim milestones for water quality are also critical--and feasible--as a way of measuring progress. The transition from progress by practice to achievement by water quality measure must begin now.

7. **The most functional unit of both analysis and intervention is the watershed.** Most people in our samples for opinion and recommendation strongly suggested the watershed approach--not only on the macro level (e.g., Chesapeake Bay) but the micro-level as well. In particular, this means looking at stream quality issues beginning at the headwaters for early contributions and alterations. Most felt that functional differentiation of pollutant sources is not really meaningful in terms of either regulation or effective change at the watershed level.

8. **EPA's role is to offer technical support and direction more than program funding or even full guidelines for state and local implementation.** In particular, building useful data bases and collection methodologies not only on water quality but on practices to achieve it is critical. Also key are training and support programs and development of effective dissemination networks. In all EPA roles, the need is to recognize both regional differences and the need for a multi-faceted set of strategies, tools, approaches, solutions.

   Another EPA function is to focus on the connection between best management practices and long term consequences for water quality. While those who introduce them are in the best position to refine BMP's, they often do not have the tools to verify a correlation (let alone a causal connection) to water quality. This is an important EPA function.

9. **A collaborative approach to developing effective solutions is possible.** The interactive elements of this project are one reflection of the ability of those with strikingly different perspectives (ranging from strong environmental protection to a focus on economic development) to work cooperatively. If adversarial and polemical dynamics can be set aside, the gains are far greater.

   Collaboration must begin within EPA itself, where there is a tendency for those focussing on permits and "harder" tools of compliance and those focussing on education and "softer" elements of prevention to not fully connect with each other. In reality, there is a strong common theme from the need to see the storm water program as a way of enabling local communities and industries to change their behaviors to help the environment in ways that will directly benefit them as well as

all other citizens.

10. **Agriculture activities should be included more directly in the storm water program.**

In many regions, agriculture (which includes livestock as well as crops) is a primary contributor to surface water pollution. While the present NPDES program requires permitting of the transport of agricultural products, this brings intervention too late. The critical first steps of agricultural activities, e.g. soil preparation, growing, and harvesting, must be included.

Beyond this reality is the signal sent that for whatever set of reasons, some interests are exempt from a program in which they clearly belong.

The Rensselaerville Institute is an independent, not-for-profit educational center chartered in 1963 by the Board of Regents of the State of New York. The Institute specializes in organizational and community development.

THE U.S. ENVIRONMENTAL PROTECTION AGENCY
OFFICE OF WATER

EPA GROUP INVOLVEMENT PROJECT

CONDUCTED BY: THE RENSSELAERVILLE INSTITUTE

REPORT SUBMITTED: SEPTEMBER 14, 1993

EPA GROUP INVOLVEMENT PROJECT

Introduction

In early 1993, The Rensselaerville Institute undertook a project designed to gain various groups' involvement in development of Phase II of the Storm Water program. Working with the U.S. EPA Office of Wastewater Enforcement and Compliance, The Institute implemented an approach whereby groups and people with interest in the Storm Water program became actively involved in identifying and discussing a series of program design options.

A series of meetings were held in Dallas, TX; Washington, DC; Chicago, IL; and Falls Church, VA. Approximately 150 people participated in the meetings.

This report describes project implementation and the method utilized, highlights the results of the project, and provides a set of recommendations for program development.

Project Implementation

One of the first steps of the project was to craft a number of options to describe how the Phase II program could be organized and implemented. At a Phase II Options Identification Meeting held in January 1993, 14 different options for target and control of Phase II storm water discharges were outlined. From the original 14, seven options were developed; each designated certain program responsibilities and authority between federal, state and local entities.

These seven options were used as the basis for focusing team work at each of the meetings. Briefly, the presented options were:

1. State Target Selection - Non-NPDES Control.

Phase II sources would be targeted by the states, using information from 305(b), 303(d) and 304(l) reports to target sources in watersheds where storm water is a significant source of impairment. Individual States would be able to select from a mix of controls to attain water quality standards. There would be no provision for Federal oversight of State control options.

2. Eliminate Phase II; Expand Phase I Designation Authority.

This option would eliminate Phase II of the storm water program. NPDES permitting authorities would retain designation authority to target and control any high risk sources of concern under Phase I of the program. The remainder of Phase II sources would be prioritized and controlled by States through existing non-NPDES control strategies.

3. NPDES Permits for Federally Selected Municipalities Not Covered Under Phase I.

Under this option, EPA would target urbanized areas and emerging growth area portions of municipalities and counties. NPDES permits would be issued to selected municipalities/counties and would require the implementation of a storm water management program through which the municipality would control commercial/industrial/residential sources within their jurisdiction.

4. Tiered Federal and State Target Selection - Tiered NPDES and Non-NPDES Control.

The first tier of high risk sources would be selected on a national basis with this option. Potential targets would include categories of facilities or activities, and urbanized and associated developing area portions of municipalities and counties. Additional sources may be selected by individual States based on information available to the State, including watershed data generated through 305(b) reports as well as 303(d) and 304(l) information. First tier high risk sources would be controlled through NPDES permits (State/EPA). Second tier sources would be controlled through a range of control measures under State discretion.

5. Federal Target Selection - Non-NPDES Control.

With this option, high risk sources would be Federally selected. Potential targets include categories of facilities or activities and municipalities located in urbanized and associated developing areas. Individual States would select their own control mechanisms for all Federally selected sources. There would be no provision for Federal oversight of State control mechanisms.

6. State Target Selection Consistent with Federal Criteria - State NPDES or non-NPDES Control.

EPA would develop selection criteria for sources (criteria would include watershed targeting and reliance on 305(b) reports as well as 303(d) and 304(l) lists as appropriate). States would identify high risk activities using these criteria. Potential targets would include categories of facilities or activities, urbanized and associated developing area portions of municipalities and counties, and sources located in affected watersheds. The State may implement either point or non-point source control measures as they see fit. Federal oversight would be exercised; sub-options would provide for different oversight schemes.

7. Federal Target Selection - NPDES Control.

With this option, high risk sources would be selected at the Federal level. Potential targets would include categories of facilities or activities, and urbanized and associated developing are portions of municipalities and counties. All sources identified would be controlled through NPDES permits.

At each of the three public meetings held, participants were presented the above list of options, and were provided the opportunity to ask clarifying questions about each one. For their first task, they were asked to identify strengths and weaknesses of each option in terms of targeting, control and timing strategies, and decide what changes if any they would make in the option to improve it. Participants were also given the opportunity to create their own option(s) for consideration.

The second task for participants at each public meeting was to list the key components that they felt should be included in a Phase II program for it to be successful, and to identify actions that EPA should avoid taking because the actions would have major detrimental effects on program success.

Participants were divided into small working teams of 6-8 people. Each team appointed one person to record group responses to each of the tasks. Following each task, teams reported out to the rest of the group.

Individual meeting reports of team responses to the options are appended to this Executive Summary. The list of options for the first meeting was slightly different than the list used for the remaining meetings in both order of option presentation and wording. The list was modified for two reasons: 1) there was a sense that, because the options were presented from most to least Federal control, people in the first two meetings may have been

unintentionally drawn to "middle of the road" options; and 2) initially, one option explicitly included a watershed approach, and therefore people may have felt that it was the only option that could incorporate it, even though the other options in no way excluded using the approach. Thus, participants in the second two meetings received the options in a different order and with explicit reference to the watershed approach given in a number of option descriptions.

Two final "expert meetings" was held in Chicago, IL and Falls Church, VA, where national storm water experts convened to review the options and suggest overall criteria for selecting a Phase II option.

Project Results

Task I: Identifying Strengths and Weaknesses of Options

At each public meeting, individual teams presented their responses to each of the options listed above. The responses of all teams for all meetings were compiled for this report. The responses of any individual team can be found, by meeting, in the appendix. Below, in discussion of various favored options, a sampling of responses across teams and meetings is presented.

Option Responses:

Across the board, meeting participants identified Option #6, "State Target Selection Consistent with Federal Criteria - State NPDES or non-NPDES Control" and Option #4. "Tiered Federal and State Target Selection - Tiered NPDES and Non-NPDES Control" as their most favored options.

Option #6, which would have States target high risk sources based upon Federally established criteria for selection and would include Federal oversight of State programs, was seen to provide the consistency needed nationwide for target selection while still allowing states the flexibility needed to control sources and identify high-risk polluters. This option was seen as easily incorporating a watershed approach, and including both point and non-point sources. Some of the strengths identified for Option #6 included:

- uniformity of selection criteria of sources among States;
- removal of the burden on States to develop selection criteria of their own;
- the flexibility to allow non-point source controls;
- giving States, who are closer to the problems and issues, more input into the decision-making process;

- giving States more latitude to develop programs which meet their own needs and high risks;
- establishing a partnership model between EPA and States, not a command-and-control model.

Some of the weaknesses that participants associated with Option #6 included:

- the probability that there would be inconsistencies between States on requirements;
- that it does not protect unimpaired waters, because the focus is on remediation not prevention;
- the potential for disagreement between State and Federal levels on the criteria established. The State may differ in the prioritization of pollutant sources;
- that Federal criteria may not be applicable to the State because of geographic, industrial, or other unique characteristics;
- a State may not have the resources to handle the program;
- the potential for State and local disagreement over controls used;
- that it could penalize progressive States that have already taken the initiative to develop a program, only to have EPA set criteria that don't "mesh" with their progress;
- the possibility that industries with multiple facilities in different States would have to deal with differences in requirements, timing, etc.

Option #4 was identified by participants as the next most favored option. According to that option, EPA would identify the first tier of high risk sources, and then the States would target additional sources as appropriate. The EPA-targeted sources would be permitted by EPA or delegated States, and then the States would have the latitude to use a range of control strategies for additional identified sources. Some of the strengths that teams listed for Option #4 included:

- would allow for quickly addressing severe problems, so the State would have more time to deal effectively with other problem sources they identified;
- provides more options for compliance in its latitude for control strategies;
- allows States more discretion and time to identify and prioritize sources;
- provides a potential advantage for industries to keep themselves clean enough so that they are not targeted for (State-selected) Tier II. This option might act as an incentive to get industries to focus on pollution prevention;

- offers the ability to incorporate less resource-intensive controls to lesser risk sources such as 404-type permits;
- Tier I allows non-contributors out of the system (since EPA would be targeting only determined high risk sources);
- seems to be more equitable than Phase I targeting and control strategies.
- permitting provides a clear point of control, i.e. the "gorilla in the closet".

Some of the weaknesses that teams associated with Option #4 included:

- the time and expense of performing risk assessments, which the States would need to do in order to target Tier II sources;
- promotes 'buck-passing' of responsibility between Federal and State levels;
- the possibility that it would create inconsistencies among States for targeting and controlling industrial categories (high risk sources);
- EPA/State coordination could be difficult, which could prolong the time it would take to implement this option;
- the potential inconsistencies that could occur for States regulating interstate waters, e.g. Chesapeake Bay.
- EPA may not have adequate information to screen and identify high risk sources on a national basis.

There did not seem to be a consistent "worst choice" option among meetings. However, among teams at the Dallas meeting, one option - Option #7, in which high risk sources would be selected at the Federal level and controlled through NPDES permits - stood out as unfavorable for six out of eight teams. Their common reason was that the Federal level would be the primary decision-maker in this option. Across all meetings, teams favored options that promoted a system of shared decision-making and responsibility reflecting the need for a partnership between Federal and State entities.

In one of the Washington public meetings, two options - option #5, in which high-risk sources would be Federally selected, with no provision for Federal oversight of control mechanisms; and Option #1, in which States would select sources and controls, with no provision for Federal oversight - were deemed the <u>least</u> favorable. In terms of Option #5, participants did not see the federal "teeth" that they felt would be needed to enforce the program. Many people across meetings felt that if there was not "the gorilla in the closet", i.e. the threat of EPA enforcement of the regulations after incentives were tried and failed, the program would not work.

Sentiment was similar regarding Option #1, and again centered around the sense that some States would do very little if the Federal government were not driving them.

It was quite apparent that, while involved groups do not want a standard command and control situation with every aspect of the program dictated at the Federal level, they still see a need and role for Federal regulatory enforcement as a motivator to get States and the regulated community to implement effective storm water programs.

Task II: Contributors to Program Success

The purpose of Task II was to have participants identify the critical factors that would help to ensure a successful storm water program, no matter which option or combination of options was selected. Teams were asked to identify the essential and basic components of a program that they believed would be required for the program to be successful. Further, they were asked to advise EPA on what the agency needed to avoid doing in order to further ensure successful program outcomes.

A summary of team responses to each of these tasks is presented below.

Task II a: Key Components for Program Success

Teams were asked to identify and list what they believed to be the key components of a successful storm water program. Responses to this task differed between group representation (e.g. State government, local government, etc.) and geographic region. There were, however, common components listed by teams across meetings. The first four items were mentioned by more than half of all work teams; the remainder were mentioned by 25-50% of the teams. The items teams identified as key to a successful program included: (in parentheses are comments made by some of the individual teams re: the item)

1. Public education and awareness programs (e.g. through trade associations, at schools, use of various media - everybody needs to be educated);

2. Training for regulators and the regulated community (e.g. for States, regions, permit writers, permittees; periodic regional/national meetings; hands-on training for municipalities and industry; dialogue and feedback between EPA, States and locals; technical assistance);

3. Timely guidances (get guidances out ahead of time as regulations are passed; provide guidance on technology transfer and innovative technology; include case studies and a data clearinghouse);

4. Determination of what lessons were learned from Phase I of the program, and mechanisms for Phase II that will allow tracking and assessment of the program within reasonable timeframes. A key factor is to allow enough time for an adequate review process of Phase I to see how Phase II could build on and expand those efforts;

5. Clear regulations (e.g. straightforward as possible; user friendly, clarity of coverage/applicability; clarity in criteria; be more specific in naming industrial activities covered under the regulations);

6. Use of a Watershed approach to implement the program;

7. National guidelines for the program (e.g. identify measurable goals for regulated sources, standards, designated use impairments, mechanisms for oversight, long range planning; recognize cost and implementation of compliance; provide realistic measures of success);

8. A phased-in approach for the Phase II program (e.g. reasonable time schedule, long-term phase-in). The most common timeframe mentioned by teams was 3-5 years for program implementation;

9. Pollution prevention incentives (send out guidance on pollution prevention to potentially regulated facilities now; offer exemptions; reduce requirements as an incentive for successful use; possibly provide a menu of programs on pollution prevention plans from which entities can pick and choose);

10. Program flexibility (e.g. to change deadlines based on hydrological flow; to implement and use elements of a watershed approach to bring in stakeholders and implement a program).

Approximately half the teams noted that there need to be some dedicated funding sources available to States, local government and permittees to assist in successful implementation of these program components. Teams felt that EPA should either provide funds or provide guidance on how States and local governments could implement fund-generating systems, e.g. storm water utilities. Team suggestions included: funding could first be made available through congressional appropriation to EPA to help programs start, and then programs could generate on-going funds through permit

fees; EPA should make available federal grants and loans to States, locals and permittees.

Task II b: EPA Actions that would be a Barrier to Program Success

Teams were asked to identify and list those actions that EPA should avoid taking lest those actions prevent programs from being successful. The actions most frequently mentioned include:

1. Unnecessary/unusable program requirements, including excessive monitoring, unrealistic BMPs and compliance criteria, cost-prohibitive Best Management Practices;

2. Fully developing requirements before pilot testing various proposed components of the program to catch inconsistencies, problems, etc. In other words, do small scale testing of program elements and use knowledge gained from those pilot tests to refine the regulations before they are put into effect;

3. Unrealistic deadlines and goals;

4. Implementing program regulations without providing dedicated program funding;

5. Promulgating the requirements without providing written guidances and technical assistance concurrent to doing so.

Criteria for Selecting A Phase II Option

The final meetings brought together storm water experts from across the country to develop an option in detail for the Phase II program. One of the products from those meetings was a developed set of criteria on which to base option selection.

Those criteria are that the program:

1. Does not rely solely on the actions of just one player. The program needs to include multiple levels: EPA, States, targeted municipalities and industries. For example, the Federal government should not be designer and decision-maker, educator, enforcer and funder. The program needs a balance of players across levels, each with a clearly defined role. Also, there needs to be a clear avenue for intervention at the Federal level if States or municipalities fail to implement the program, i.e. "the gorilla in the closet".

2. Provides clear guidance and unambiguous targeting categories and words (e.g., words like "sufficient" should be avoided, at least if there is no way to define what they mean in a given context). Simplicity and clarity should be favored; words that are ambiguous or hazy should be avoided. The regulations must be clear to the regulated community in terms of goals, objectives and implementation if EPA is to gain "buy-in" from them.

3. Provides the resources (not only dollars, but people as well) or suggests how they can be obtained for that option. The program needs to be clear on who pays for what, e.g. Federal, State, local, permittee.

4. Is flexible, especially in recognizing regional and local differences, not only in terms of storm water pollutant loadings but also in terms of their environmental impact. For example, even if all gas stations put out an equal volume of pollution, the environmental impact may vary depending on location. Or as another example, recognition of the vast differences between States, such as mid-Atlantic compared to Southwest, which would mean a vast difference in what they need in terms of a storm water program.

5. Needs to be nationally consistent in the underlying methodology used, i.e. consistent national guidelines, identified goals, measures of success, etc. while at the same time recognizing regional differences and allowing flexibility to implement a program that best addresses the particular characteristics of local problems.

6. Emphasizes the need for program responsibility and authority that is "pushed" down to a local level. The sense of some of the participants in this meeting was that the best understanding of the problem and how to deal with it is the people closest to the problem who have to deal with it, i.e. local problem/local government and groups. Note: People representing local government at the meetings were extremely concerned about the lack of resources and technical expertise that might be found at the local level in many situations. The need for adequate funding was again identified as a critical issue, and some suggested that utility districts would be the only real way to fund the program unless the cost is low enough that it could be covered in a regular budget. The group agreed as a whole that resources and technical expertise not withstanding, this program must be accepted and supported at the local level if it is to be successful.

7. Provides the opportunity to integrate other water issues and concerns--e.g., groundwater. For example, restriction on certain BMPs affects groundwater impacts. The methodology used should allow integration with groundwater, habitat, and other water programs. It needs to integrate or be compatible with other sections of the Clean Water Act, e.g. right now 402 causes 401 and 404 compliance problems.

8. Needs to build on and tie to Phase I, where much work was done and where momentum has been established. A lull now means the need for a new start up - right now the energy level is high and awareness of the storm water program has been growing, so EPA needs to tap into that forward movement. If EPA waits too long in getting Phase II out, inertia will set in, and it will take much more energy and effort to get it in place. And the talented people will go on to something else (208 was given as an example).

Other key areas of expert discussion around Phase II program considerations included:

1. **EPA needs to recognize the potential gaps between "best efforts" and performance standards.** On the one hand, we have a variety of ways of characterizing best efforts: Best Management Practices (BMP's) and Maximum Extent Practicable (MEP) are examples. These are inputs, presumed to influence water quality. On the other hand, we have water quality standards that are outcomes. One question: what do we do if people follow BMP's and water quality does not improve to the standards we set? What if the "maximum extent practicable" is deemed in place and we still have an outcome shortfall?

2. **Two distinct structural premises are in play.** One is of a national program which is administered by the States. In this view, EPA provides mandates, and supports state and local efforts to reach them. The other premise is more decentralized. It is seen as a set of State programs and initiatives which share a national performance target. In at least some respects, the structural premise held suggests different programmatic approaches in such areas as desired and allowable variability among states and localities.

3. **Much wisdom about storm water controls are not readily generalizable.** BMP's in the residential development field, for example, were said, by some experts, to hold true for a scale of 5 - 50 acres. And many watersheds for which solutions are designed are actually very small. It is hard to "scale up" answers.

4. **Program "champions" are often a factor in program success.** One expert observed, and others agreed, that the individuals involved in storm water programs were as much a reason for high program performance as was the program plan. We should be careful to allow for this factor in the emphasis on rules, procedures, and even workplans.

5. **Pollution prevention should be emphasized.** While often anecdotal, a variety of examples were offered of situations in which preventive steps solved a water quality problem. These examples, like the Puget Sound program discussed in our earlier report, were generally focused and interactive. They did not rely on the spread of information alone to prompt changes in behavior.

6. **EPA needs to allow State and local flexibility to address priorities as they have identified them.** The theme of selectivity combined often with local flexibility. e.g., in some areas, a little more grease has a tremendous negative impact on the environment. In others, it does not. Selectivity on targeting is also clear, e.g., that BMP's on new land development (commercial as well as residential) would pay high dividends vs. other generalized targets.

7. **Several equity or fairness issues emerge and persist.** One concerns those sources targeted. If a discharger has done everything in their permit -- all the BMP's are in place -- and the water is still dirty, is he or she liable? Another is the distinction between larger organizations (corporate or municipal) with resources to handle permits and processes and much smaller ones which lack that capacity. To what extent is the same rule as "fair" for the small town as for the big city?

8. **The Federal role in the program to establish a partnership with States, and be an enabler rather than an enforcer.** Participants felt that EPA's responsibilities would be to develop national goals and guidelines, set national selection criteria, establish a selection methodology, and develop a universal methodology for selecting controls that would allow programs to choose alternatives based upon their needs, e.g. regional and local differences. Participants felt strongly that Federal oversight is a necessary component to ensure that States do implement programs, i.e. be the "gorilla in the closet". However, in a partnership capacity, participants felt EPA should first be ready to provide support and technical assistance rather than punitive measures to programs that were not meeting standards despite best efforts.

APPENDIX J

SUMMARY OF PHASE II COMMENTS

Organization of Phase II Comments

I. Targeting

A. General Targeting Approaches for Both Municipalities and Industries

	Yes	No
■ Examine Phase I data before selecting Phase II sources. **[1.g.iv]**	52	0
■ Amend CWA and eliminate Phase II/ cover additional sources under Phase I **[1.a]**	28	7
■ Establish requirements for State storm water programs to identify additional sources. **[1.f]**	18	5

■ **Examine Phase I data before selecting Phase II sources. [1.g.iv]**

The majority of the commenters (52 commenters) agree that a close examination of Phase I is essential before launching into Phase II. Many of these commenters also stressed that EPA should complete the Reports to Congress, as specified under section 402(p)(2)(5) of the CWA. Such an examination would allow EPA to evaluate whether the current approach is achieving the intended goals, or whether another approach to storm water permitting would be more effective. As discussed in detail later, commenters expressed a number of concerns about the storm water program, including 1) the high cost associated permit compliance and program administration; 2) the ineffectiveness and inequity of "blanket coverage" of particular industrial activities that do not pollute while other "bad polluters" remain unregulated; and 3) a general uncertainty about the goals of the storm water program and whether, in fact, these goals are being achieved under current program.

■ **Amend CWA and eliminate Phase II by covering additional sources under Phase I; administer through NPDES or section 319 (NPS) or section 6217 (CZARA). [1.a]**

To address these problems associated with Phase I, commenters indicate that a change in how facilities are targeted is necessary. Of the 91 commenters, approximately a third (28) favor amending the CWA to eliminate Phase II of the storm water program and to bring additional sources under Phase I. As far as regulating these Phase II sources under Phase I, the majority of commenters prefer a continued reliance on the NPDES program as opposed to State non-point source programs (funded under Section 319 of the CWA and/or section 6217 of the CZARA). While commenters support continued reliance on NPDES, they overwhelmingly agreed that Phase II

sources should not be targeted by EPA headquarters but rather by State and/or local entities.

These commenters argue that by eliminating Phase II and bringing additional sources under Phase I, the problems associated with Phase I storm water permitting will be most effectively addressed. In particular, by designating facilities under section 402(p)(2)(E), States can target those industrial activities that are impacting sensitive watersheds and/or posing the greatest environmental risk. One State agency notes EPA should "maintain national data for determining environmental risk, establish priorities for additional activities to be covered under a storm water permit, and coordinate compliance, enforcement and educational information among the States."

The majority of commenters believe that designation authority in the hands of the State would be the most cost-effective targeting approach. However, other commenters express concern over shrinking State budgets and indicate that additional funding would be needed, particularly if the program were administered under section 319.

Those commenters opposing the elimination of Phase II (7 commenters) argue that for reasons of equity Phase II sources should be subject to the same requirements as Phase I. The concern is that State designation of Phase II sources may result in inconsistencies throughout the country. One municipality argues that in order to effectively protect water quality, smaller municipalities should be required to develop the same storm water management programs as the medium and large municipalities were required to under Phase I.

- **Establish requirements for State storm water programs to identify additional sources. [1.f]**

18 commenters out of 91 commenters favor the targeting option whereby EPA would establish Phase II requirements for State NPDES storm water programs to identify additional sources. 5 oppose this option.

Those supporting this option believe that States and local entities (not EPA) should be identifying additional sources for Phase II permitting, adding that EPA should somehow direct the States and municipalities to develop programs appropriate to their unique requirements and monitor the progress of these programs. As far as EPA's exact role in this process, some commenters assert that EPA should establish baseline effluent limitations for particular industries and then establish control measures for these industries. Other commenters believe that such determinations should be made by the State, with EPA maintaining its important role as an information and guidance clearinghouse. One State agency writes that "minimum criteria in the area of funding levels and educational requirements seems appropriate." These commenters indicate

that this approach is preferable as it establishes consistent criteria for the development of State storm water programs.

B. Options for Targeting Phase II Industrial Sources

	Yes	No
■ Geographic Targeting: Designate additional individual sources in watersheds of concern (those not meeting designated water uses) and in specific rainfall zones **[1.e/1.g.i]**	48	5
■ Focus on high-risk polluters and exempt facilities that don't pollute. **[1.d/1.g.ii]**	39	3
■ Rely on Phase I MS4s to target industrial sources that discharge through their system. **[1.c]**	9	11

■ **Geographic Targeting: Designate additional individual sources in watersheds of concern (those not meeting designated water uses) and in specific rainfall zones. [1.e./1.g.i]**

Almost half of the 91 commenters (45 commenters) support targeting sensitive watersheds, i.e., those that have high pollutant loadings and/or those not meeting designated uses. These commenters argue that such an approach is the most cost-effective way to improve the quality of the Nation's water. (Please note that within this category, more commenters support permitting watersheds under the NPDES program than under State nonpoint source programs). Commenters suggested that this approach should be coupled with identifying the industry "bad actors" within watersheds of concern. (Identification of "bad actors" is discussed in the following section).

A number of commenters believe that watersheds should be prioritized based on criteria such as threats to high quality resources or significant degradation. One industry offered the following suggestions for a watershed strategy: "1) Conduct a survey of receiving watersheds and rank them based upon their designated uses and level of contamination; 2) Identify and prioritize major sources of pollutant loadings; 3) Analyze the control measures to control these pollutant sources and prioritize them based on cost effectiveness." Some commenters stress the importance of developing national criteria for evaluating watersheds so as to avoid inconsistencies among different regions.

In terms of evaluating watersheds, commenters suggest using the following CWA mechanisms: Section 303(d) which prioritizes a ranking of waters, section 305(b) which describes water quality of all navigable waters in the State, section 319 watershed listings, and section 304(l) which lists waters not expected to meet water quality standards. Some commenters suggest that sampling data from Phase I cities be used to generate regionalized watershed loading criteria.

Regarding costs, a number of commenters agree that targeting watersheds would be more cost-effective for both industries and States than current targeting strategies. However, some States express concern over the cost of gathering watershed-specific information in a timely manner. One State argues that "entirely too much effort would need to be invested to determine what waters have been negatively impacted by storm water runoff. Using the lists from 305(b) reports is not sufficient nor acceptable."

As far as designating specific sources by rainfall zone, there was some scattered support for this measure. However, most commenters agreed that it could be difficult and costly to generate timely, meaningful data that could justify variances or special conditions between regions.

- **Focus on high-risk polluters and exempt facilities that don't pollute. [1.d/1.g.ii]**

Nearly half of the commenters (39 commenters) supported targeting high-risk industrial polluters. Only three commenters opposed the option. As discussed above, many commenters believe that targeting of "bad actors" should be linked to the targeting of sensitive watersheds.

In general, commenters feel that the Phase I targeting of industries based on SIC codes was not cost-effective. In addition, many commenters believe that a number of the big industrial polluters were not included under Phase I of the storm water program. Commenters unanimously agree that bad actors who are contributing to water quality degradation should be targeted for Phase II permitting, while those "good actors" who don't pollute should be exempted. This approach, commenters say, would reduce the regulatory burden on all those facilities that are not contributing to water quality problems.

One State agency stressed that determinations of "bad actors" must be done on a State or local basis, not by EPA. "Controlling activities that are specifically designated by EPA could be a significant waste of time and resources if a particular jurisdiction has other activities that contribute to higher pollutant loads." This commenter suggested using data gleaned from municipal applications to determine Regional water quality information.

As far a which particular "bad actors" should be targeted under Phase II, commenters suggested the following industries: gas/auto service, State highways, large parking lots (malls), tank farms, commercial activities with industrial components, and construction activities of less than five acres. Please note, however, that a number of trade organizations representing the above industries submitted lengthy comments outlining why their industries do not pose environmental risks.

Those commenters opposing the option (3 commenters) claim that focusing on "bad actors" is a reactive strategy rather than a preventative one. Further, one commenter argues that using impairment would be imprudent as States (after more than a decade) still have not completed inventories of their waters. The commenter further states that agricultural runoff and irrigation return flows, which are exempted under the CWA, constitute some of the worst pollution in the country. One commenter suggests the continued use of SIC codes but with exemptions provided for those who have proven that they don't pollute.

- **Rely on Phase I MS4s to target industrial sources that discharge through their system. [1.c]**

11 commenters opposed the targeting option whereby Phase I MS4s would target industrial sources discharging through their systems; 9 commenters supported the option.

Those commenters opposing this option feel that the burden of regulating Phase II industrial dischargers would be too great, and that this role rightfully belongs to the State. Further, commenters believe that water quality problems are not confined to individual municipalities, but rather they span entire watersheds. These commenters argue that standards would not be uniform--or efforts might not be coordinated--between different municipalities and, therefore, regulation through State or EPA would be more equitable. Municipalities indicate a willingness to assist States in targeting Phase II sources, for example, by providing a list of potentially high-risk industries. Commenters supporting this option believe that because Phase I municipalities already have their storm water management plans in place, they are the most appropriate entity to identify additional sources under Phase II.

C. Options for Targeting Phase II Municipalities

	Yes	No
■ Identify MS4s based on population, population density, and/or population growth. **[1.b]**	20	20
■ Geographic Targeting: Designate additional municipal sources impacting watersheds of concern (those not meeting designated water uses) and in specific rainfall zones **[1.e/1.g.i]**	48	5
■ Permit small municipalities but establish simplified application requirements. **[1.g.iii]**	15	1

■ **Identify MS4s based on population, population density, and/or population growth. [1.b]**

Commenters are split evenly (20 in favor, 20 against) Phase II MS4s being targeted on the basis of population, population density and/or population growth.

Commenters in support of this approach argue that municipalities having particularly dense populations and those experiencing intense population growth due to new development should be of primary concern under Phase II of the storm water program. One commenter also notes that MS4s could be targeted on the basis of watershed population. At any rate, numerous commenters agree that effective Phase II storm water programs must be coordinated on a regional basis [perhaps in conjunction with those already established under Phase I]. This would allow for the development/implementation of regional policies and regional BMPs, and would facilitate addressing specific issues such as land use, structural controls and construction activities. As discussed later, the majority of commenters supporting this approach also advocate the establishment of simplified permit application requirements.

The majority of the comments opposing this option are from small municipalities. Approximately half of these commenters believe that municipal storm water management should be conducted on a watershed basis rather than by determining population density and/or growth. The other half opposes Phase II regulation of small municipalities altogether. "Phase II regulations will have a very significant impact on municipal budgets if implemented similar to Phase I," 11 municipalities wrote. "These will entail increased staff levels, testing, consulting fees and other costs which are unduly burdensome, particularly where there is no Phase I documentation to show

that environmental quality is enhanced." Of primary concern among municipal commenters is the astronomical cost associated with completing municipal storm water permit applications. They argue that funds do not exist to implement the storm water program and that political pressures would prevent them from securing storm water utilities.

- **Geographic Targeting: Designate municipalities impacting watersheds of concern (those not meeting designated water uses) and in specific rainfall zones. [1.e./1.g.i]**

As discussed under the "Industrial Targeting" section, nearly half of the 91 commenters (45 commenters) support targeting sensitive watersheds, i.e., those that have high pollutant loadings and/or those not meeting designated uses. While targeting these watersheds can help identify significant industrial polluters, many commenters also believe that this approach is useful in identifying MS4s for storm water permitting.

These commenters argue that since watersheds are oftentimes a patchwork of rural, suburban and urban lands comprised of incorporated and unincorporated areas, storm water permits should apply to the jurisdiction as a whole, not just to individual municipalities within the watershed. Commenters note that in watersheds of concern, all Phase II municipalities could become co-permittees with Phase I municipalities. Where it is determined that watersheds are not polluted, Phase II municipalities would not be required to obtain a storm water permit. This option provides opportunities for municipalities to reduce administrative burdens, consolidate efforts to study or evaluate approaches, and greatly reduce costs of program development and implementation. Although a great deal of regional coordination would be required, commenters believe that such an approach would yield the greatest environmental benefit.

(Please refer to the "Industrial Targeting" section for a summary of options for targeting on a watershed basis).

- **Permit small municipalities but establish simplified application requirements. [1.g.iii]**

15 commenters support the idea of permitting small municipalities but establishing simplified application requirements. Arguing that Phase I municipal permit application requirements (particularly Part 2 requirements) were burdensome and overly costly, these commenters suggest that Phase II municipalities be covered under a simplified general permit that requires a storm water management plan and flexible watershed-specific monitoring requirements. One commenter suggests the following components of a Phase II municipal program: 1) *Sediment and Erosion Control*:

Applicants incorporate erosion control into the development review and local permitting process; 2) *Storm Water Quality Control*: Applicants incorporate storm water BMPs into the municipal development review and approval process and into municipal operations; and 3) *Illicit Discharges*: Applicant prohibits illicit connections and improper dumping, he/she develops a spill prevention and response plan.

II. Control Strategies

A. General Control Strategies for Both Municipalities and Industries

	Yes	No
■ Continue to rely on NPDES programs; use NPDES general permits that focus on BMPs. **[2.a/2.d.i]**	32	4
■ Rely on nonpoint source programs administered under section 319 of the CWA and section 6217 of CZARA. **[2.b]**	20	3
■ Establish mandatory national Phase II performance standards without a permit. **[2.c]**	14	10

■ **Continue to rely on NPDES programs; use NPDES general permits that focus on BMPs [2.a.]**

Approximately 32 commenters favor the continued use of NPDES programs to regulate storm water discharges. 19 commenters prefer reliance on State nonpoint source programs under section 319. Most commenters state that it would be inefficient to discontinue the current program, and, as one commenter notes, displacing the NPDES program would "create a significant amount of confusion among authorized NPDES States and the regulated community." Additionally, the NPDES storm water permit program is in the initial stages of development and results may not be realized for at least two years. The majority of the commenters who support reliance on the NPDES program encourage use of general permits, for an "emphasis on the development of effective programs, not on lengthy and expensive application processes." Most commenters believe that BMPs are a more effective control strategy and a better allocation of resources than monitoring and numeric effluent limitations. BMPs utilized should be those which proved cost effective for Phase I sources.

- **Rely on nonpoint source programs administered under section 319 of the CWA and section 6217 of CZARA. [2.b.]**

Approximately 21 commenters favor the use of State nonpoint source programs and/or section 6127 of CZARA to regulate Phase II storm water discharges. Many of these commenters assert that storm water runoff is a nonpoint source rather than a point source and therefore should be regulated under section 319. Moreover, State nonpoint source programs are already developed and utilizing them would lessen the repetition of water quality programs. Several commenters emphasize, however, that if State nonpoint source programs were expanded to include storm water runoff, additional funding would be essential. Those commenters that supported the use of section 319 see it beneficial in that the program encourages flexibility through voluntary control measures, pollution prevention, and watershed planning. Several commenters express some trepidation that nonpoint sources may be moved under the NPDES program, and assert that nonpoint sources should continue to be covered under section 319, not NPDES.

- **Establish mandatory national Phase II control strategies without requiring a permit. [2.c.]**

Commenters are fairly divided on whether EPA should establish national control strategies for Phase II sources. Various statements from the 12 commenters who support mandatory guidelines indicate that this approach would be cost-effective and would alleviate the administrative burdens of permit applications. A few commenters also state that, in order to be most effective, the guidelines and management practices should be industry-specific. A model that is mentioned by several commenters is the Puget Sound Water Quality Management Plan and the Washington State Department of Ecology's Stormwater manual for the Puget Sound Basin. These commenters suggest that all States adopt a similar storm water management plan which would be required to at least meet a national standard; all municipalities within the State would have to adhere to the plan.

11 of the commenters who address this control strategy oppose mandatory national control guidelines for Phase II activities. Several commenters believe it would be difficult to effectively notify and educate the general population concerning the details of such a program. Other commenters express concern that the diversity in climate and topography throughout the country requires more flexibility than national standards would provide.

B. Key Elements of a Control Strategy

	Yes	No
■ Focus on education for public and affected industry. **[2.d.ii]**	18	0
■ Emphasize pollution prevention incentives and BMPs, particularly for new development. **[2.d.iii]**	17	0
■ Establish correlation between severity of pollution and controls required, using fines to aid implementation. **[2.d.iv]**	3	0

■ **Focus on education for public and affected industry. [2.d.ii]**

14 commenters state that education needs to be a primary focus of the Phase II program. One commenter notes that EPA should "keep it simple," particularly on issues on coverage, since Phase II dischargers may be smaller and less familiar with environmental regulations than Phase I dischargers. Commenters unanimously stress the importance of public education and outreach. They urge that EPA/States 1) distribute guidance documents and fact sheets prior to implementing the rule, 2) provide examples of pollution prevention programs, 3) conduct workshops, 4) prepare video presentations for distribution, and 5) launch public education campaigns geared towards explaining water quality problems associated with storm water.

■ **Emphasize pollution prevention incentives and BMPs, particularly for new development. [2.d.iii]**

14 commenters support an emphasis on voluntary pollution prevention programs. This approach is favored because of its cost-effectiveness, flexibility, and reduction in regulatory burden. Additionally, several commenters indicate that it would establish a 'partnership' between the regulated community and regulatory agencies by encouraging dialogue and guidance concerning pollution prevention techniques. One State notes that the voluntary measures in its nonpoint source program have proven very successful in improving water quality, and that similar practices could be implemented for storm water runoff. The State recommends, however, that voluntary approaches be used in conjunction with mandatory approaches and that "provisions be included for requirements placed on 'bad actors' if cooperation is not attained through the voluntary programs." Numerous commenters point out that education would need to be far-reaching if the voluntary programs were implemented.

- **Establish correlation between severity of pollution and controls required, using fines to aid implementation. [2.d.iv.]**

  Only 3 commenters address this control strategy, and all 3 support a correlation between severity of pollution and controls required. One commenter writes that, "market based incentives structured to incorporate true economic externalities associated with pollution can be a valuable tool in helping society balance economic growth and levels of pollution." Another commenter notes that State agencies should administer the fine/implementation system, as States can adjust their controls based on the types of pollutant sources and sensitivity of the watersheds in a particular region.

III. Deadlines

A. Options for Program Deadlines [3]

	Yes	No
■ October 1, 1995 or later	12	
■ Prioritize sources; establish phased deadlines	3	
■ Eliminate Phase II; no deadlines	1	
■ Pending thorough review of Phase I	20	
■ H.R. 6167 deadlines satisfactory	3	
■ Before October 1, 1994	3	

Commenters unanimously feel that Phase II should not be implemented until a thorough review of Phase I has been completed. A number of these commenters indicated that Phase II regulations should not be published before October 1, 1995.

IV. Costs/Regulatory Burden

A. Issues associated with costs and regulatory burden

■ Balancing the need to protect the environment with the cost-effectiveness of the program **[III.A.2]**
■ Examining the impacts of the storm water program on small businesses and communities **[III.A.7]**
■ Assessing the regulatory burden on permittees and regulators **[III.A.3/III.A.4]**

General Cost/Benefit Concerns

Nearly a third of the commenters (26 commenters) express concern over the costs associated with implementing the storm water program, and whether these costs justify the need to protect the environment.

Municipalities, in particular, voice concern over the costs associated with completing municipal permit applications and implementing storm water management programs. One commenter argues that while cities across the nation have spent over $1 trillion dollars to implementing the program, water quality is not significantly improving because of upstream discharges not regulated under the CWA. This commenter further states that since urban runoff affects only 11% of river impairment and 29% of lake impairment, the price tag of implementing storm water management programs is not justified. (Please note that a number of commenters question EPA's methodology in 305(b) reports as it pertains to assessing "designated uses" for waterbodies).

Comments indicate that across the board--among cities, small business owners, and trade associations--the storm water program is viewed as a major financial burden on communities and industries. Of particular concern for cities (and especially small cities) is the number of growing number of projects/regulations that need to be supported by shrinking municipal budgets. Generating a storm water utility to support the program has proven politically difficult in a number of cities. On the industrial side of the program, there are equally as many concerns over costs and benefits. In particular, commenters argue that a number of small industries which pose little risk to the environment were required to apply for a storm water permit under Phase I, while "higher risk" industries such as oil and gas, agriculture, and retail gasoline facilities were not covered by the rule. A number of small industries claim that sampling is cost-prohibitive and that the quantitative data generated are oftentimes inaccurate/meaningless. Regarding Phase II, one construction operator

argues that inclusion of construction operations under 5 acres would render these small-scale activities cost-prohibitive.

Strategies for Phase II

In closing, commenters offer the following suggestions for maximizing cost-effectiveness and environmental benefit under Phase II:

- Phase I of the storm water program must be thoroughly assessed in terms of dollars spent and environmental benefits gained before launching into Phase II.
- EPA and/or States must incorporate a more realistic benefit/cost analysis of Phase II, particularly for the municipal side of the program.
- Under Phase II, emphasize storm water management and pollution prevention rather than sample gathering and analysis. (A number of the quantitative requirements under Part 2 of the municipal permit application were viewed as unnecessary and overly costly)
- EPA and States should use data generated from Phase I of the program so as to make Phase II more cost-effective and environmentally beneficial.
- Rely more heavily on State or local entities for storm water program administration.

V. General Concerns/Issues Related to the Storm Water Program [4]

■ Lack of adequate outreach/public education/timely guidance during Phase I resulted in confusion about: * Which facilities are subject to regulation (use of SIC codes viewed as confusing, inappropriate) * The types of permit application options available * Deadlines * The relationship between the industrial and municipal programs * The overall relevance of the program
■ Confusion resulted from different requirements in different States (i.e., those with approved NPDES programs and those without) particularly in regards to the group application process.

■ **Lack of adequate outreach/public education/timely guidance during Phase I resulted in confusion over a number of issues, including:**

Use of SIC codes. A number of commenters indicated that there was widespread confusion during Phase I over which facilities were subject to regulation. In particular, the use of SIC codes to determine regulatory status was viewed as confusing. Multiple activities commonly occur at a single facility and people were frequently unclear as to how they are classified under the SIC code system. Due to this excessive confusion, commenters generally feel that SIC codes are an ineffective way of targeting facilities for regulation under the storm water program.

Application Options. Commenters complained that the storm water permit application options were not spelled out clearly in the beginning of the program. In particular, some expressed anger over the group application process. One commenter notes that while the group application option seemed preferable a year ago, it became clear that this option was problematic given that certain States are not accepting group applications as legal coverage. In addition, a number of group applicants would have opted for coverage under the general permit had that option been available in the first place. Commenters resented that it was oftentimes necessary to hire expensive consultants simply to understand the regulations and stay informed of their application options.

Deadlines. Commenters indicate that there was confusion surrounding permit application deadlines. In the future, this could be alleviated by improved outreach and public education.

The relationship between the industrial and municipal programs. One commenter recommends separating municipalities and industries into two distinct rules so as to avoid confusion over the differences between the two programs.

The "Big Picture" of the storm water program. As discussed throughout this report, commenters seem frustrated over the fact that huge costs are being incurred to implement the storm water program without a clear indication that environmental benefits are being achieved. Commenters write that it essential for EPA to step up public education and outreach efforts in the future.

- **Confusion resulted from different requirements in different States (i.e., those with approved NPDES programs and those without) particularly in regards to the group application process.**

Numerous commenters state that the conflicting time frames between States and EPA in developing and issuing the permits created enormous confusion for the regulated community. As discussed above, this situation was particularly frustrating members of group applications.

APPENDIX K

SELECTED MANAGEMENT MEASURES DEVELOPED UNDER SECTION 6217 OF CZARA

SELECTED MANAGEMENT MEASURES DEVELOPED UNDER SECTION 6217 OF CZARA[1]

MANAGEMENT MEASURES FOR URBAN AREAS (Chapter 4 of CZARA guidance)

I. INTRODUCTION

II. URBAN RUNOFF

A. New Development Management Measure

(1) By design or performance:

(a) After construction has been completed and the site is permanently stabilized, reduce the average annual total suspended solid (TSS) loadings by 80 percent. For the purposes of this measure, an 80 percent TSS reduction is to be determined on an average annual basis,[2] or

(b) Reduce the postdevelopment loadings of TSS so that the average annual TSS loadings are no greater than predevelopment loadings, and

(2) To the extent practicable, maintain postdevelopment peak runoff rate and average volume at levels that are similar to predevelopment levels.

Sound watershed management requires that both structural and nonstructural measures be employed to mitigate the adverse impacts of storm water. Nonstructural Management Measures for new development (B&C) can be effectively used in conjunction with this Management Measure reduce both the short-and long-term costs of meeting the treatment goals of this management measure.

B. Watershed Protection Management Measure

Develop a watershed protection program to:

(1) Avoid conversion, to the extent practicable, of areas that are particularly susceptible to erosion and sediment loss;

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[1] See "Guidance Specifying Management Measures for Sources of Nonpoint Pollution in Coastal Waters," January 1993, U.S. EPA, 840-B-92-002.

[2] Based on the average annual TSS loadings from all storms less than or equal to the 2-year/24-hour storm. TSS loadings from storms greater than the 2-year/24-hour storm are not expected to be included in the calculation of the average annual TSS loadings.

(2) Preserve areas that provide important water quality benefits and/or are necessary to maintain riparian and aquatic biota; and

(3) Site development, including roads, highways, and bridges, to protect to the extent practicable the natural integrity of waterbodies and natural drainage systems.

C. Site Development Management Measure

Plan, design, and develop sites to:

(1) Protect areas that provide important water quality benefits and/or are particularly susceptible to erosion and sediment loss;

(2) Limit increases of impervious areas, except where necessary;

(3) Limit land disturbance activities such as clearing and grading, and cut and fill to reduce erosion and sediment loss; and

(4) Limit disturbance of natural drainage features and vegetation.

III. CONSTRUCTION ACTIVITIES

A. Construction Site Erosion and Sediment Control Management Measure

(1) Reduce erosion and, to the extent practicable, retain sediment onsite during and after construction, and

(2) Prior to land disturbance, prepare and implement an approved erosion and sediment control plan or similar administrative document that contains erosion and sediment control provisions.

B. Construction Site Chemical Control Management Measure

(1) Limit application, generation, and migration of toxic substances;

(2) Ensure the proper storage and disposal of toxic materials; and

(3) Apply nutrients at rates necessary to establish and maintain vegetation without causing significant nutrient runoff to surface waters.

IV. EXISTING DEVELOPMENT

A. Existing Development Management Measure

Develop and implement watershed management programs to reduce runoff pollutant concentrations and volumes from existing development:

(1) Identify priority local and/or regional watershed pollutant reduction opportunities, e.g., improvements to existing urban runoff control structures;

(2) Contain a schedule for implementing appropriate controls;

(3) Limit destruction of natural conveyance systems; and

(4) Where appropriate, preserve, enhance, or establish buffers along surface waterbodies and their tributaries.

V. ONSITE DISPOSAL SYSTEMS

A. New Onsite Disposal Systems Management Measures

(1) Ensure that new Onsite Disposal Systems (OSDS) are located, designed, installed, operated, inspected, and maintained to prevent the discharge of pollutants to the surface of the ground and to the extent practicable reduce the discharge of pollutants into ground waters that are closely hydrologically connected to surface waters. Where necessary to meet these objectives: (a) discourage the installation of garbage disposals to reduce hydraulic and nutrient loadings; and (b) where low-volume plumbing fixtures have not bee installed in new developments or redevelopments, reduce total hydraulic loadings to the OSDS by 25 percent. Implement OSDS inspection schedules for preconstruction, construction, and postconstruction.

(2) Direct placement of OSDS away from unsuitable areas. Where OSDS placement is unsuitable areas is not practicable, ensure that the OSDS is designed or sited at a density so as not to adversely affect surface waters or ground water that is closely hydrologically connected to surface water. Unsuitable areas include, but are not limited to, areas with poorly or excessively drained soils; areas with shallow water tables or areas with high seasonal water table; areas overlaying fractured bedrock that drain directly to ground water; areas within floodplains; or areas where nutrient and/or pathogen concentrations in the effluent cannot be sufficiently treated or reduced before the effluent reaches sensitive waterbodies;

(3) Establish protective setbacks from surface waters, wetlands, and floodplains for conventional as well as alternative OSDS. The lateral setbacks should be based on soil type, slope, hydrologic factors, and type of OSDS. Where uniform protective

setbacks cannot be achieved, site development with OSDS so as not to adversely affect waterbodies and/or contribute to a public health nuisance;

(4) Establish protective separation distances between OSDS system components and groundwater which is closely hydrologically connected to surface waters. The separation distances should be based on soil type, distance to ground water, hydrologic factors, and type of OSDS;

(5) Where conditions indicate that nitrogen-limited surface waters may be adversely affected by excess nitrogen loadings from ground water, require the installation of OSDS that reduce total nitrogen loadings by 50 percent to ground water that is closely hydrologically connected to surface water.

B. Operating Onsite Disposal Systems Management Measure

(1) Establish and implement policies and systems to ensure that existing OSDS are operated and maintained to prevent the discharge of pollutants to the surface of the ground and to the extent practicable reduce the discharge of pollutants into ground waters that are closely hydrologically connected to surface waters. Where necessary to meet these objectives encourage the reduced use of garbage disposals, encourage the use of low-volume plumbing fixtures, and reduce total phosphorus loadings to the OSDS by 15 percent (if the use of low-level phosphate detergents has not been required or widely adopted by OSDS users). Establish and implement policies that require an OSDS to be repaired, replace, or modified where the OSDS fails, or threatens or impairs surface waters;

(2) Inspect OSDS at a frequency adequate to ascertain whether OSDS are failing;

(3) Consider replacing or upgrading OSDS to treat influent so that total nitrogen loadings in the effluent are reduced by 50 percent. This provision applies only:

(a) where conditions indicate that nitrogen-limited surface waters may be adversely affected by significant ground water nitrogen loadings from OSDS, and

(b) where nitrogen loadings from OSDS are delivered to ground water that is closely hydrologically connected to surface water.

VI. POLLUTION PREVENTION

A. Pollution Prevention Management Measure

Implement pollution prevention and education programs to reduce nonpoint source pollutants generated from the following activities, where applicable:

- The improper storage, use, and disposal of household hazardous chemicals, including automobile fluids, pesticides, paints, solvents, etc.;
- Lawn and garden activities, including the application and disposal of lawn and garden care products, and the improper disposal of leaves and yard trimmings;
- Turf management on golf courses, parks, and recreational areas;
- Improper operation and maintenance of onsite disposal systems;
- Discharge of pollutants into storm drains including floatable, waste oil, and litter;
- Commercial activities including parking lots, gas stations, and other entities not under NPDES purview, and
- Improper disposal of pet excrement.

VII. ROADS, HIGHWAYS, AND BRIDGES

A. Management Measure for Planning, Siting, and Developing Roads and Highways

Plan, site, and develop roads and highways to:

(1) Protect areas that provide important water quality benefits or are particularly susceptible to erosion or sediment loss;

(2) Limit land disturbance such as clearing and grading and cut and fill to reduce erosion and sediment loss; and

(3) Limit disturbance of natural drainage features and vegetation.

B. Management Measure for Bridges

Site, design, and maintain bridge structures so that sensitive and valuable aquatic ecosystems and areas providing important water quality benefits are protected from adverse effects.

C. Management Measure for Construction Projects

(1) Reduce erosion and, to the extent practicable, retain sediment onsite during and after construction and

(2) Prior to land disturbance, prepare and implement an approved erosion control plan or similar administrative document that contains erosion and sediment control provisions.

D. Management Measure for Construction Site Chemical Control

(1) Limit the application, generation, and migration of toxic substance;

(2) Ensure the proper storage and disposal of toxic materials; and

(3) Apply nutrients at rates necessary to establish and maintain vegetation without causing significant nutrient runoff to surface water.

E. Management Measure for Operation and Maintenance

Incorporate pollution prevention procedures into the operation and maintenance of roads, highways, and bridges to reduce pollutant loadings to surface waters.

F. Management Measure for Road, Highway, and Bridge Runoff Systems

Develop and implement runoff management systems for existing roads, highways, and bridges to reduce runoff pollutant concentrations and volumes entering surface waters.

(1) Identify priority and watershed pollutant reduction opportunities (e.g., improvements to existing urban runoff control structures; and

(2) Establish schedules for implementing appropriate controls.

MANAGEMENT MEASURES FOR ANIMAL FEEDLOTS (Chapter 2.II.B of CZARA guidance)

B1. Management Measures for Facility Wastewater and Runoff from Confined Animal Facility Management (Large Units not subject to NPDES permit requirements)

Limit the discharge from the confined animal facility to surface waters by:

(1) Storing both the facility wastewater and the runoff from confined animal facilities that is caused by storms up to and including a 25-year, 24-hour frequency storm. Storage structures should:

(a) Have an earthen lining or plastic membrane lining, or
(b) Be constructed with concrete, or
(c) Be a storage tank;

and

(2) Managing stored runoff and accumulated solids from the facility through an appropriate waste utilization system.

B2. Management Measures for Facility Wastewater and Runoff from Confined Animal Facility Management (Small Units not subject to NPDES permit requirements)

Design and implement systems that collect solids, reduce contaminant concentrations, and reduce runoff to minimize the discharge of contaminants in both facility wastewater and in runoff that is caused by storms up to and including a 25-year, 24-hour frequency storm. Implement these systems to substantially reduce significant increases in pollutant loadings to ground water.

Manage stored runoff and accumulated solids from the facility through an appropriate waste utilization system.

APPENDIX L

PRESIDENT CLINTON'S CLEAN WATER INITIATIVE (PORTIONS RELATED TO STORM WATER PROGRAM)

United States
Environmental Protection
Agency

Office of Water
Washington, D.C.

EPA 800-R-94-001
February 1994

PRESIDENT CLINTON'S CLEAN WATER INITIATIVE

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STORM WATER PROGRAMS

ISSUE:

How should CWA storm water requirements be revised to strengthen and facilitate implementation of storm water controls?

BACKGROUND:

States report that approximately 30 percent of remaining surface water quality impairment is attributable to storm water discharges. Significant sources of storm water discharges include urban runoff, industrial activity, construction, and resource extraction (mining). For example, in urban areas, loadings from storm water runoff for heavy metals, sediment, bacteria, polycyclic aromatic hydrocarbons (PAHs), acidity, and floatables are higher than those from POTWs.

To address these environmental risks, Congress established in 1987 a two-phased storm water program under CWA §402(p). Phase I applies to municipal storm sewer systems serving a population over 100,000, as well as storm water discharges associated with industrial activity.

In November of 1990, EPA issued regulations that identified 220 municipalities whose separate storm sewer systems are subject to Phase I of the NPDES program. States and EPA have designated an additional 550 municipalities as part of the Phase I program. The Agency estimates that the Phase I municipalities have a population of over 90 million people (about 36 percent of the total U.S. population). EPA and authorized States have received comprehensive permit applications from many of the municipalities, and are in the process of developing and issuing permits for these dischargers.

In addition, the Phase I regulations established regulation of over 100,000 industrial facilities in eleven categories, including manufacturing, mining, waste management, construction, and transportation. Permits for storm water discharges from Phase I industries generally were required to be issued by October 1, 1993. The Ninth Circuit struck down EPA's exemption from Phase I regulations of construction sites under 5 acres and light industrial activities "with no exposure" to rain water.

Phase II applies to all remaining light industrial, commercial, retail, and residential facilities with storm water discharges that are not in Phase I. Preliminary estimates indicate that millions of facilities are not addressed by Phase I. Phase II is potentially ten times larger in scope than Phase I, and could address a large number of municipalities without significant urban populations. EPA was required to issue Phase II regulations by October 1, 1993, which would designate classes of Phase II storm water discharges to be regulated to protect water quality. Phase II sources are

required to obtain a permit by October 1, 1994. EPA did not meet the October 1993 deadline for Phase II regulations.

Municipal Compliance with Standards

Municipal separate storm sewer systems (or "MS4"--those municipal systems that are covered by the storm water program) have stated that it is both technologically and financially impossible to establish treatment or management practices that can ensure that urban storm water runoff complies with water quality standards. They have indicated that it is highly uncertain whether feasible storm water control measures (source controls, traditional structural controls, and best management practices) will ensure that storm water discharges will meet water quality standards. They further argue that the only other alternative, collecting and treating essentially all of the storm water from widespread urbanized areas, would be infeasible and result in significant destruction of urban streams and wetlands.

Under the existing CWA, §402(p)(3)(B)(iii), a statutory standard exists that NPDES storm water discharge permits issued to municipal separate storm sewer systems require controls to reduce the discharge of pollutants in storm water to the "maximum extent practicable" (MEP). The statutory standard can include management practices, control techniques, and system design and engineering methods and other such provisions that the Administrator or State determines are necessary for the control of such pollutants. Because of the lack of a more specific definition of the statutory standard of MEP, municipalities, permitting authorities, and members of the public are uncertain as to the extent of storm water control requirements a municipality must implement in its storm water management program.

Provisions for Facilities with No Exposure

EPA attempted to exempt from storm water control requirements certain industrial facilities that had no exposure of materials, equipment, or wastes to storm water. However, this exemption of facilities without storm water exposure was overturned by the Ninth Circuit. Such an exemption, if reinstated through legislation, would create a strong incentive for facilities to implement pollution prevention. It would simultaneously accomplish environmental objectives (reducing pollutants in storm water) and greatly reduce administrative burdens for EPA, States, and industries.

Deadline Extensions for Phase II

EPA is presently required to issue Phase II regulations designating sources for permitting and establishing deadlines by October 1, 1993. In the absence of new regulations, Phase II sources are required to have permits after October 1, 1994. Given the scope and complexity of Phase II, EPA was unable to meet the October 1, 1993 regulatory deadline. Furthermore, EPA and authorized States will not be able

to issue permits to all Phase II sources by October 1, 1994. This may expose unpermitted dischargers, including many small municipalities or commercial enterprises posing small risks, to litigation for discharging without a permit. In addition, potential Phase II municipalities need additional time to develop the financial capabilities and institutional frameworks needed to comply with storm water requirements.

Phase II Storm Water Requirements

Phase II regulations must be reasonable in scope and establish a workable program that will focus on sources of storm water discharges that pose the highest risk. The Bureau of Census has designated 396 urbanized areas which represent the most widespread and dense urban development. These urbanized areas occupy less than 2 percent of the total land area of the United States but contain 165 million people, or about 65 percent of the total population of the United States. In addition, most new development occurs in or adjacent to these urbanized areas. Between 1980 and 1990, over 75 percent of the national increase in population occurred in these urbanized areas. However, over 5,000 municipal entities in urbanized areas are not in Phase I of the NPDES storm water program.

Authorize Municipalities to Directly Regulate Storm Water Facilities Within Their Jurisdiction

Under current CWA provisions, the storm water program requires permits for industrial activities even if they are discharging to municipal separate storm sewer systems which also must obtain storm water permits. Municipalities argue that this is redundant and inefficient, and also undercuts their effectiveness in directly dealing with an industrial facility.

Inactive and Abandoned Mines

It is estimated that there are in the range of 400,000 or more inactive and abandoned mine sites (IAMs) on Federal lands. The environmental damages posed by these sites can vary significantly. While many sites are relatively benign, releases from other sites result in significant environmental degradation, even decades after active operations have ceased. A major administrative challenge is to (1) prioritize these sites that cause environmental problems so that the United States can address them in a rational environmentally protective manner, and (2) effectively protect water resource quality by addressing these sites according to the prioritized order. Another major challenge is to target control measures so as to achieve the greatest improvement in environmental quality for the limited Federal resources that may be available. Although the estimates of total costs of mitigating water resource quality impacts from IAMs vary significantly, they range into the many tens of billions of dollars without such cost-effective, risk-based prioritization.

A significant number of IAMs on Federal lands are believed to have point source discharges of pollutants, as defined under current statute and regulation, to waters of the United States subject to regulation under the NPDES permit program. Given the large number of IAMs and the costs of mitigating sites causing environmental impacts; there is a need for a phased, cost-effective, risk-based prioritized approach to mitigating these sources.

RECOMMENDATIONS:

The Administration recommends that the CWA be amended to do the following--

Municipal Compliance with Standards

- Establish a phased permit compliance approach that requires best management practices in first-round municipal storm water permits, and through improved best management practices in second-round permits, where necessary, to move towards compliance with water quality standards. In later permits, compliance with water quality standards will occur using water quality based effluent limits, where necessary. This would give EPA and municipalities additional time to evaluate the technical feasibility of establishing numeric effluent limits to meet water quality standards and give States time to develop specific water quality standards appropriate for storm water discharges, if necessary.

- The Administration supports clarifying authority under section 402(p)(3)(B) concerning "maximum extent practicable" (MEP). In contrast to best available technology economically achievable (BAT) and best conventional pollutant control technology (BCT) that are applicable for storm water discharges associated with industrial activities, under MEP, storm water management programs can be implemented in a site-specific and flexible manner to address the storm water management concerns in the municipality. It should be made clear that MEP allows for the consideration of different factors including: (1) the severity of the impairment caused by the source, (2) the effectiveness of alternative approaches at reducing storm water discharges, and (3) the cost of control measures. Under MEP, a storm water management program can target controls based on differences in the type and size of sources, climate, geography, and water quality concerns. Based on a statutory clarification, EPA will then issue guidance on the best methods by which to implement MEP in NPDES permits.

- The Administration supports encouraging States to review and revise their designated uses and water quality standards implementation procedures, as they develop water quality-based permits, to reflect the episodic nature of storm water runoff, the varying loadings during storm water events, and the

potential resilience of natural ecosystems to some infrequent, temporary incremental loadings.

Provisions for Facilities with No Exposure

- Authorize EPA to exempt from individual storm water permitting requirements facilities that can certify that there is no nor will be exposure of industrial or other activities or significant materials to rain water and snow melt. This change would ensure that several hundred thousand low-risk facilities are not subject to NPDES requirements, allowing allocation of resources to more critical areas. This would also effectively create incentives for facilities to eliminate contamination of storm water.

Deadline Extensions for Phase II

- Extend the Phase II deadline for EPA issue to regulations to October 1, 1997. Also, extend the deadline to obtain a permit to October 1, 1999. These extensions are necessary to allow EPA to work with States and municipalities in developing workable, effective regulations. Extending the deadline for permits would give municipalities an opportunity to begin to build institutional frameworks and provide the funding necessary to implement storm water management programs. It would also allow permits to be issued to Phase II municipalities at the same time Phase I permits are expiring. This will promote regional and watershed-wide permitting by allowing different municipalities to be co-applicants and coordinate their storm water programs.

Phase II Storm Water Requirements

- Focus Phase II requirements on system-wide permits for municipal separate storm sewer systems in Census-designated urbanized areas with a population of 50,000 or more.

- Target storm water management programs for municipal separate storm water systems (MS4) in the 138 Phase II urbanized areas associated with a Phase I permitted MS4 to address, at a minimum, non-storm water discharges into storm sewers and storm water runoff from growth and development and significant redevelopment. The CWA should encourage NPDES permitting authorities as part of a watershed approach to implement a more comprehensive municipal storm water management program where appropriate based on water quality impairments or other factors for the MS4s in these urbanized areas. In the remaining 258 Phase II urbanized areas, storm water management programs would be required which focus only on controlling non-storm water discharges into storm sewers and storm water runoff from growth and development and significant redevelopment activities.

- Under Phase II for those MS4s required to implement a storm water management program targeted to growth, development and significant redevelopment and illicit connections, the municipal program will control those Phase II storm water sources, including discharges from construction of less than 5 acres, which are part of growth, development, and significant redevelopment activities and may address, where appropriate, subject to the MEP standard, those Phase II sources causing water quality impairment. For those municipal separate storm sewer systems required by the NPDES permitting authority to implement a more comprehensive storm water management program, Phase II light industrial, commercial, retail, and institutional storm water sources would be addressed through the program under the municipality's NPDES storm water permit, which meets the MEP standard. Phase II sources not addressed through a municipal program would not be covered by the NDPES program.

- Do not directly regulate Phase II light industrial, commercial, retail, and institutional storm water discharges, and municipalities outside of Census-designated urbanized areas under the NPDES program, unless otherwise designated by the permitting authority for inclusion in the NPDES program under §402(p)(2)(E) of the CWA. (EPA does not expect that this designation process would be used, except in highly-unusual circumstances, to require an NPDES permit for a typical homeowner.) Rather, such discharges could be addressed by NPS program, if they were a targeted source.

<u>Authorize Municipalities to Directly Phase I Industrial Regulate Storm Water Facilities Within Their Jurisdiction Under the NPDES Program</u>

- Allow EPA and authorized States to authorize municipalities to establish programs for Phase I industrial storm water permit issuance and controls, where it has the appropriate authority, and is willing to commit to implement Federal requirements. EPA does not envision Federal funding to be available to municipalities to perform this function. This recommendation is similar to the industrial pretreatment program currently authorized under the CWA. As in the industrial pretreatment program, storm water permits and controls that are issued by municipalities in an EPA-approved program would be Federally enforceable.

<u>Inactive and Abandoned Mines</u>

- The Administration recommends that the CWA be amended to make the following changes to the NPDES permitting program to target control measures so as to achieve the greatest improvement in environmental quality for the limited Federal resources available for inactive and abandoned mine sites (IAMs) without an operator present:

- The Administration supports clarifying authority to issue NPDES permits on a State-wide basis for IAMs within resource management units (e.g., one permit per State for the National Forest Service, National Park System, Bureau of Land Management, or Fish and Wildlife Service resource areas). This would allow Federal land managers to establish State-wide priorities based on impairment or threats to water resource quality and the most effective use of the available resources. Such priorities could allow some sites not to be controlled or be subject to relatively less stringent controls.

- The Administration supports an amendment to substitute, for existing technology-based requirements under the NPDES program for IAMs on Federal lands, the authority for Federal land managers to identify water resource quality that is threatened or impaired by IAMs and to implement targeted controls for such sites, similar to existing authority for permits for municipal separate storm sewer systems contained in section 402(p)(3)(B).

- The Administration further supports allowing, in general, no more than up to ten years to meet appropriate water quality standards within a resource management unit, as defined in the language above, from the date of issuance of an NPDES permit to the Federal land manager. The Federal land manager would be expected during this period to 1) strive to achieve water quality standards as expeditiously as possible, 2) continue to assess the water resource quality impacts of IAMs where they are currently unknown, and 3) continue to implement targeted controls for those sites causing impairments or threats once identified. This provision should not apply to IAMs which were permitted under the NPDES program prior to the date of enactment.

- The Administration supports encouraging States to review and revise their designated uses and water quality standards implementation procedures, as they develop water quality-based permits, to reflect the episodic nature of storm water runoff, the varying loadings during storm water events, and the potential resilience of natural ecosystems to some infrequent, temporary incremental loadings.

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PRESIDENT CLINTON'S CLEAN WATER INITIATIVE:

Analysis of Benefits and Costs

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4.0 Storm Water

EPA's current Phase I storm water program requires NPDES permits of cities and counties with municipal separate storm sewer systems (MS4s) serving populations of 100,000 or more and "storm water discharges associated with significant industrial activity." The Phase II program, currently suspended due to a Congressional moratorium, could require permits for all private sources of storm water (commercial, industrial, retail, and institutional) and all MS4s serving all populations that have the potential to affect water quality. In the Initiative, EPA has addressed the potentially high costs of the Phase II program while still providing protection from private sources and additional MS4s.

The "worse case" scenario for storm water permitting reflects the most inclusive option of all potential options that EPA would consider in proposing rules for the types of facilities covered under Phase II. If EPA were to propose regulations for permitting Phase II facilities, EPA may propose to cover only a portion of these facilities, based on consideration of costs incurred and environmental benefits gained. EPA could propose regulations covering the same facilities to the same extent as suggested in the Initiative.

The Initiative's Phase II program will focus on system-wide permits for MS4s in Census-designated urbanized areas--i.e., areas with a population of 50,000 or more and a population density of 1,000 persons per square mile. The Census Bureau has identified 396 such urbanized areas nationwide. Phase II MS4s will be required to implement storm water management programs that are subject to a "maximum extent practicable" (MEP) standard. These programs will, at a minimum, address: (1) nonstorm water discharges to their systems (i.e., illicit connections) and (2) storm water runoff from growth and development and significant redevelopment activities (including discharges from construction of less than 5 acres) and, where appropriate, those Phase II sources causing water quality impairment.

Where the NPDES authority deems it necessary, MS4s in the 138 urbanized areas associated with a Phase I permitted MS4 may be required to have a more comprehensive storm water management program (consistent with the Phase I storm water requirements). The comprehensive storm water management programs would cover Phase II light industrial, commercial, retail, and institutional storm water sources under a municipality's storm water permit. The NPDES program would not cover Phase II sources not addressed through a municipal program. Such discharges could be addressed by the NPS program if they were a targeted source.

4.1 Private Sources

Under a stringent interpretation of the CWA, the current Phase I program is estimated to cost industrial permittees $3.99 billion per year, while Phase II under a similarly stringent interpretation could cost as much as $16.23 billion in annual costs.

To account for the uncertainty in estimating the potential costs, EPA has developed ranges. These ranges account for variations in both the number of sources affected and the costs incurred. The Initiative's Phase II plan would reduce these impacts on commercial, service, and institutional facilities considerably, imposing costs of between $0.34 billion and $1.67 billion per year, as follows:

	Low	High
10,000 facilities x $22,340/facility	$0.22 billion	
28,000 facilities x $34,700/facility		$0.97 billion
96,000 facilities x $630/facility	$0.06 billion	
269,000 facilities x $1,885/facility		$0.51 billion
100,000 sites x $630/site	$0.06 billion	
100,000 sites x $1,885/site		$0.19 billion
TOTAL	**$0.34 billion**	**$1.67 billion**

From a universe of 1.1 million significant sources, EPA has identified 100,000 that are similar to Phase I industrial sources while the remaining 1.0 million are retail, commercial, and institutional. Of the 100,000 industrial sources, approximately 60 percent or 60,000 have no storm water exposure. Of the remaining 40,000 sources, EPA has assumed that municipalities will require between 25 and 70 percent of the facilities to install storm water controls. To further account for the uncertainty inherent in projecting costs, EPA has used $22,340 per facility at the low end and $34,700 per facility at the high end of the estimated cost to comply (EPA, 1994c). The total cost for industrial look-a-likes is estimated to be between $0.22 billion and $0.97 billion per year.

Of the remaining 1.0 million sources, 60 percent are located in urbanized areas and may be addressed under storm water management programs for the urbanized areas. As above, 36 percent, or 216,000 sources, are estimated to have no storm water exposure. Of the remaining 384,000 sources, or 64 percent, the low-end number of facilities (96,000 sources or 25 percent) could incur costs as low as $630 per facility, while the high-end number of facilities (269,000 sources or 70 percent) could incur costs as high as $1,884 per facility.

In addition, 40 percent of the private sources that are not covered by a municipal program would be covered by the NPS program. Under the NPS program, only the sites located in impaired watersheds would need controls. EPA believes roughly 25 percent of these sites are in impaired watersheds. At a range of $630 and $1,885 per site and 100,000 sites, the annual costs will be between $0.06 billion and $0.19 billion.

Based on these estimates, the Initiative's total cost on private sources is between $0.34 billion and $1.67 billion. Compared to EPA's best interpretation of current law and assuming

that the moratorium will expire, the Initiative will avoid costs (or yield a cost savings) of between $14.6 billion and $15.9 billion.

The Initiative may also result in potential cost savings for those facilities currently or soon to be permitted under the existing storm water Phase I regulations. About 60 percent of existing permitted industrial sources and 100 percent of potentially permitted light industrial sources will not require NPDES permits under the Initiative's provisions. In addition, small (less than 5 acre) construction sites will be considered Phase II sources, and this would result in additional cost savings of $70 million per year. As a result, additional cost savings to private sources from Phase I requirements will be between $1.1 billion and $1.6 billion.

The above estimates are derived in EPA, 1994c, and are summarized here. Based on a stringent interpretation of the current law, the overall cost savings (or costs avoided) to private sources from these provisions would be in the range of $15.7 billion and $17.5 billion, as shown in Table 21.

4.2 Municipalities

Costs for the current Phase I program for municipal sources are estimated at between $1.6 billion and $2.6 billion annually, based on a covered population of 69.3 million people and per person costs of between $23.91 and $37.00 per person.[8]

If the Phase II moratorium expires, EPA could be required to promulgate regulations covering an additional population of at least 74.1 million people (25.3 million in 138 urbanized areas associated with Phase I MS4s, 29 million in 258 additional urbanized areas between the population of 50,000 and 100,000, and potentially 19.8 million in other MS4s). EPA's best interpretation of the current law is that it would not include these additional 28 million in other MS4s. Using the same unit costs ($23.91 to $37.00), the existing Phase II program could cost between $1.8 and $2.7 billion per year.

To account for the uncertainty of the impact in terms of the number of municipalities affected and the costs incurred, EPA has estimated a range of costs for the Phase II provision in the Initiative. The following estimates are derived in EPA, 1994c, and are summarized here. About 25.3 million people live in 138 urbanized areas (UAs) with growth and development and illicit discharge. Costs range from a low of $15.33 per capita to a high of $23.72 per capita. The range of total costs for these urbanized areas is between $0.39 billion and $0.60 billion. Next, EPA assumed that between 25 and 70 percent of the population in these UAs will be covered by a comprehensive program based in part on the percentage of impaired urban waters. The population affected will be between 6.33 million and 17.7 million. The additional cost of

[8] Population estimates for the municipal storm water costs are from the draft "Report to Congress on Storm Water Dischargers Not Regulated Under Phase I of the NPDES Storm Water Program" (EPA, 1993d). Average costs are from the draft EPA report "Review of Program Costs in Part 2 NPDES Municipal Storm Water Permit Applications" (EPA, 1993c).

a comprehensive plan above the cost of addressing growth and development and illicit discharges will be in the range of $8.58 and $13.28 per capita. The total cost of the comprehensive coverage will vary from a low of $0.05 billion to a high of $0.24 billion.

EPA identified 29 million people in another 258 UAs who will be affected by the Phase II provisions. The cost of compliance will vary from $15.33 per capita to $23.72 per capita. The total cost of this coverage will be in the range of $0.44 billion and $0.69 billion. The final element of this cost on municipalities is the cost of addressing private sources and industrial look-a-likes that impact water quality in areas without the comprehensive program and in areas with combine sewers. At a per capita cost of $2.00, EPA estimates that about 75.7 million people will incur $0.15 billion. At a per capita cost of $5.00, the upper-end cost would be $0.38 billion.

	Low	High
25.3 million population x $15.33 per capita	$0.39 billion	
25.3 million population x $23.72 per capita		$0.60 billion
6.33 million population x $8.58 per capita	$0.05 billion	
17.7 million population x $13.28 per capita		$0.24 billion
29.0 million population x $15.33 per capita	$0.44 billion	
29.0 million population x $23.72 per capita		$0.69 billion
75.7 million population x $2.00 per capita	$0.15 billion	
75.7 million population x $5.00 per capita		$0.38 billion
TOTAL	**$1.03 billion**	**$1.91 billion**

The total cost to the municipalities of the proposed Phase II requirements is between $1.03 billion and $1.91 billion, as shown in Table 20.

Compared with the cost of Phase II requirements under a stringent interpretation of the current law, total savings to municipalities will be between $755 million and $850 million per year.

4.3 State Water Programs

The impacts of the Phase II storm water provisions on states have not been estimated but are expected to be minimal.

4.4 Federal Agencies

Additional costs of the storm water provisions on federal agencies will total $19 million per year. EPA will account for $2 million per year of this cost, and DOI will account for $17

million per year.

4.5 Benefits[9]

The benefits of storm water control as proposed in the Initiative are based on numerous case studies and are summarized as follows:

- 75 to 80 percent reduced loadings in urbanized areas prior to and during development,
- 15 to 25 percent reduced loadings in areas already developed,
- Greater environmental protection at lower cost,
- Improved water resource quality, habitat, and aquatic life; reduced flooding; improved recreational opportunities; increased commercial fishing; improved human health; and increased employment.

(Note that more cost-effective and institutionally feasible prevention and management methods are available for new development than for areas that have already been developed.)

Case Studies[10]

Bellevue, Washington (see longer summary in Appendix B)

Bellevue has a population of nearly 87,000 and covers a 30-square mile area that contains five lakes and over 50 miles of open streams. The city established a storm water utility in 1974 to maintain a hydrologic balance, prevent property damage, and protect water quality.

The city requires newly developing areas to include on-site storm water management that provides protection for 24-hour, 100-year storm events.

Examples of program benefits:

-- Flood control. One of the most successful aspects of the program is flood control, which relies on eight remote-controlled regional detention basins along major stream corridors to monitor rainfall, stream flow, and water levels. This helps ensure that flood gates control peak flows. Small detention basins reduce peak flow rates up to 60 percent, providing flood and stream-bank erosion control and protecting stream-side property.

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[9] See also the EPA (1994e) background paper "CWA Benefits of Storm Water Controls," January 1994.

[10] Costs for these case studies were not available and hence are not included here.

-- Reduced property damage. As a result of storm water controls over the previous 10 years, property damages were avoided during a 100-year storm in January 1986.

-- Reduced pollutant loadings. Runoff concentrations of lead and total solids were reduced by 10 to 25 percent through biannual cleaning of storm drainage inlet pumps and catch basins; oxygen demanding substances, nutrients, and zinc concentrations were reduced by 5 to 10 percent. Conventional street-sweeping operations reduced toxic loadings by 5 to 10 percent. Installation and maintenance of oil/water separators reduced floatables in the drainage system.

-- Reduced illegal dumping. Dumping of motor oil and debris in storm drains was significantly reduced through increasing public awareness of storm water issues and volunteer stenciling of storm drains. A recent survey indicates that 85 percent of area residents dispose of used oil at a recycling facility.

-- Increased recreational opportunities. Clean-up of Mercer Slough (a 325-acre wetland) along with stream and wildlife enhancement of the park resulted in increased canoeing on the slough and increased visitation to the park's trails.

Murray City, Utah

Murray City (population 31,000) worked with the Utah Department of Transportation (DOT) to develop a storm water control system for runoff from a 4.5-mile stretch of highway in conjunction with the construction of an 18-hole, 135-acre municipal golf course.

Storm water runoff from the highway and subsurface waters is collected and routed through a series of streams and wetlands into four ponds on the golf course.

Examples of program benefits:

-- Reduction in pollutant loadings. The pond system removes approximately 90 percent of the sediment, oil and grease, and dissolved materials from the highway runoff.

-- Flood control. The system successfully handled the runoff from two 25-year storms.

-- Savings in irrigation water costs. The detention ponds provide 7 acres of flood retention area and created nearly 11 acres of wetlands. The ponds also provide water to irrigate the golf course, which saves nearly $80,000 per year in watering costs.

-- Savings in highway construction costs. Because runoff was diverted to irrigate

the golf course, DOT saved $300,000 in land acquisition and storm water piping costs by eliminating the need to construct a separate storm water discharge system for the highway.

Orlando, Florida

The city of Orlando (population 160,000) receives over 50 inches of rain annually, over half of which converts to storm water runoff and flows into the city's 83 lakes. One example of a project to manage storm water is the creation of the Greenwood Urban Wetland, which consists of several ponds in a series.

Examples of program benefits:

-- Increased property values. Overall, whenever Orlando constructs a storm water control lake, property values in that area increase.

-- A savings was realized in construction of the Greenwood Urban Storm Water Control Wetland with the sale of fill dirt that was excavated ($5/cubic yard).

-- Creation of a natural park. The Greenwood Urban Wetland created a natural park atmosphere (with footbridges, walking paths, picnic areas, and opportunities for observing wetland wildlife) in an urbanized area.

-- Irrigation and drinking water supply. Cleansed storm water is used to irrigate the upland areas of the park, which conserves the drinking water supply.

Santa Clara Valley, California

Santa Clara Valley has a municipal storm water permit covering 15 co-permittees (14 municipal entities and one water control district). Three of the municipalities have populations over 100,000, four are between 50,000 and 100,000, and seven are less than 50,000.

Transportation activities have been identified as potentially the most significant source of storm water pollutants. Copper and zinc have been identified as significant contaminants in the storm water runoff into south San Francisco Bay. These metal are carried by suspended particles. Brake pad dust is believed to be a major source of the copper.

Examples of program benefits:

-- Significant reduction in copper loadings. Street sweeping activities clean 19,000 miles per month and have prevented 2,500 pounds of copper and 46,000 cubic yards of material throughout the area from entering storm sewers.

-- Reduction in floatables. Cleaning 34,000 catch basins has removed 1,000 cubic

yards of material. Inspection and cleaning of 160 miles of conveyances has removed 400 cubic yards of material.

-- Identification of illegal dumping activities. The co-permittees identified 867 cases of illegal dumping, of which 700 have been resolved.

Tulsa, Oklahoma

The city of Tulsa (population 367,000) has been recognized as having an effective storm water management program. EPA recently issued a draft municipal storm water permit for Tulsa.

Discharges from Tulsa's storm sewer collection system were identified as a source of pollutant loadings in the Zinc Lake portion of the Arkansas River. The storm sewer's discharges showed a high concentration of bacteria.

Examples of program benefits:

-- Removal of suspended solids. Tulsa estimates that its construction site storm water controls average 70 percent effectiveness in removing total suspended solids from storm water runoff. In addition, the city estimates that its street sweeping and structural operation and maintenance reduce suspended solids by up to 50 percent; metals by up to 10 percent; total solids and lead by 10 to 25 percent; and oxygen demanding substances, nutrients, and zinc by 5 to 10 percent.

-- Improved Water Quality in the Arkansas River. The city identified 35 illicit storm sewer connections drained into Zinc Lake and the Arkansas River. Tulsa removed these discharges from the storm sewer system and states that water resource quality has improved as a result.

STORM AND SURFACE WATER UTILITY
BELLEVUE, WASHINGTON

Bellevue, Washington, is a suburban community located in the Puget Sound area east of Lake Washington in the Seattle metropolitan area. The city experienced substantial population growth during the last 30 years and particularly rapid growth over the last 20 years. When Bellevue incorporated as a city in 1953, the population was approximately 6,000 and the city limits covered five square miles. By 1990, Bellevue had grown to a population of 86,000 and an area that covered 30 square miles, making it the fourth largest city in Washington State. Recent estimates indicate that the watershed is over 90 percent developed, primarily with residential units and commercial and light industrial uses.

Rapid growth and development created storm water runoff problems in most of the natural streams draining the area. The city's 30-square mile area contains over 50 miles of open streams and five lakes. Much of the average annual rainfall of 42 inches is carried by existing streams into the following receiving waters: Kelsey Creek, Meydenbauer Bay and the Lake Washington East Channel, Yarrow Bay on Lake Washington, Lake Sammamish, and Coal Creek. Of these, Lake Washington is considered the primary receiving water body. The types of storm water runoff problems documented in the Bellevue area include increased flooding and streambank erosion; property damage; stream sedimentation/siltation; diminished salmon runs; water quality degradation by discharges of nutrients, heavy metals, pesticides, and oil; and illicit connections.

In response to citizen concerns about environmental degradation caused by storm water runoff, the city of Bellevue established a storm water utility in 1974. The mission of Bellevue's Storm and Surface Water Utility (SSWU) is to manage the storm and surface water system in Bellevue, to maintain a hydrologic balance, to prevent property damage, and to protect water quality for the safety and enjoyment of citizens and the preservation and enhancement of wildlife habitat.

STORM AND SURFACE WATER UTILITY PROGRAMS

When first established, Bellevue's utility focused on examining various solutions to control flooding and preserve waterways. The utility selected an "open stream concept" using streams as the main conveyance system for storm water runoff. This system uses regional, in-stream flood control facilities to attenuate peak flows for older development. The utility also manages the municipal storm drainage system. In addition, regulations require developers to provide erosion and sedimentation controls at all construction sites and on-site storm water controls for new development. With successful flood control systems in place, the focus has recently shifted to water quality controls, including requirements mandated by the federal Clean Water Act. For the most part, SSWU's comprehensive effort to solve storm water quality

problems is preventive in nature, but the utility also recognizes the need for retrofitting and new capital improvements for treatment.

Management of Bellevue's storm drainage system and open streams involves five major programs: a capital improvement program, operations and maintenance, water quality control, public education, and administration. Activities conducted under each of the major programs are summarized below.

- **Capital improvement program.** SSWU's capital improvement program (CIP) involves planning, design, property acquisition, flood control construction, water quality treatment, and stream enhancement projects. The utility constructed a series of 11 in-stream flood control facilities (detention basins) within the Bellevue stream system to provide protection for the 24-hour, 100-year storm event. SSWU also improves stream passages for carrying capacity, stability, wildlife habitat, and migratory fish passage.

- **Operations and maintenance.** The operations and maintenance (O&M) program involves those functions typically associated with urban drainage, such as repair and minor replacement of SSWU's structural facilities. Bellevue's O&M program also includes operation of structures for flood control, including a telemetry control system for structures and an emergency storm response program, a drainage system inventory, and advice to private citizens on private drainage concerns.

- **Water quality control.** Activities conducted for water control include drainage system cleaning, routine monitoring of receiving waters, investigative monitoring of pollution events and sources, emergency response for water pollution events, coordination with other water quality control agencies, participation in lake restoration studies and projects, a private maintenance inspection program, and a streams enhancement program.

- **Public education.** SSWU's public education efforts focus on available services and the environment. Specific activities include articles in local publications about SSWU services and the effects of human practices on the environment, the Stream Team Program (includes a water quality newsletter, workshops, and citizen activities), City Hall's "Mini Salmon Hatchery" and annual salmon release, storm drain stenciling projects, and a business water quality program.

- **Administration.** Administrative programs for SSWU include financial management, rate administration, comprehensive drainage planning, general administration, and support for the City Council and Storm and Surface Water Advisory Commission. SSWU assures quality control of utility services by tracking all service requests through an automated Customer Action Request system.

UTILITY FINANCING

The city decided that the most equitable system of drainage service charges entails basing changes on the estimated amount of runoff that individual properties contribute to the surface water system. All properties are classified according to their intensity of development. Each classification is assigned a rate (per 2,000 square feet of property area), with current rates set as follows: undeveloped ($0.17), light development ($0.99), moderate development ($1.23), heavy development ($1.83), and very heavy development ($2.46). Wetlands are also a class; however, wetlands are not charged due to their value in water quantity and quality control. The classification combined with the total square footage of the property determines the service charge, which is billed every two months.

Revenues grew slowly until rates were raised to fund the adopted Capital Improvement Program, which was initiated by issuance of $10 million in revenue bonds. Three major rate increases occurred in 1980 (70 percent), 1982 (90 percent), and 1986 (35 percent), and subsequent rate increases have remained in the single-digit category largely to cover inflation. Although the majority of SSWU revenue is from service charges, other revenue sources include clearing and grading permit fees, general facilities charges, and interest on fund accounts. Revenues from the utility service charges and these other sources cover the full costs of Bellevue's storm and surface water management program.

Single-family customers make up 92 percent of the 24,000 accounts and contribute 45 percent of the revenue. An average single-family household pays $16.44 every two months ($98 per year) for 10,000 to 12,000 square feet of property with a typical home. Tax-exempt properties are not exempt from the utility charges. (Washington State highways and Bellevue streets are the SSWU's two biggest ratepayers.)

BENEFITS OF THE STORM AND SURFACE WATER PROGRAM

One of the most successful of SSWU's programs is flood control, and several different approaches to managing storm water discharges are achieving water quality improvements. In addition, Bellevue's reputation as a well-planned, environmentally sensitive city is enhanced through SSWU programs that preserve the city's numerous streams.

Reductions in Peak Flows

- Bellevue's use of the natural stream system to manage storm water preserves the environment and reduces costs. Bellevue's storm water management activities to address flooding and stream erosion problems range from four to ten times less costly than traditional storm sewer improvements.

- Small detention basins (detention times of 30 minutes or less) reduced peak flow rates by up to 60 percent, providing flood and streambank erosion control that protects streamside property.

- With a computerized remote control system, maximum flood protection along major stream corridors is achieved through eight regional detention basins. The remote control system monitors rainfall, stream flow, and water levels to ensure optimal operation of flood gates to control peak flows.

- During a 100-year storm experienced by the Bellevue area in January 1986, property damages occurred only where planned improvements were not yet constructed. Capital improvements totalling $15 million and constructed over the previous 10 years reduced flooding and streambank erosion, thereby avoiding property damages.

- Calls for emergency service during storm events continue to decrease, indicating that SSWU's flood control system has significantly reduced hazards to life and property.

Reductions in Pollutant Loadings/Discharges

- Runoff concentrations of lead and total solids were reduced by between 10 to 25 percent over a two-year period through biannual cleaning of storm drainage inlet sumps and catch basins. Chemical oxygen demand (COD), nutrient, and zinc concentrations were reduced by between 5 to 10 percent over a two-year period.

- Toxic loadings were reduced by between 5 and 10 percent by conventional street-sweeping operations.

- Introduction of floatables to the drainage system was reduced by the installation and maintenance of oil/water separators, some of which have the capability of reducing oil and grease during oil spill events to levels generally associated with background levels in urban storm water.

- Dumping of motor oil and debris in storm drains was significantly reduced by increasing public awareness of storm water issues through SSWU's Stream Team Program and volunteer stenciling of storm drains. A recent survey indicates that 85 percent of area residents dispose of used oil at a recycling facility.

- Dumping of motor oil and household chemicals was also reduced through SSWU's Oil Recycling and Hazardous Waste Program. SSWU collected 2,100 gallons of petroleum products at a recycling event in October 1993.

- Total solids in urban runoff originating from residential yards were reduced by increasing public awareness of practices such as pet waste and litter control.

- A wide variety of local businesses work with SSWU water quality staff to prevent storm water pollution at the source through an innovative program called Business

Partners for Clean Water.

Protection or Restoration of Ecological Resources

- Volunteers have planted thousands of native trees and shrubs along 10 miles of Bellevue's open streams to shade stream waters and enhance fish habitat. Other stream enhancement projects conducted through the Stream Team Program have reduced streambank erosion which also lowered water temperatures and provided shade to enhance fish habitat.

- Kelsey Creek's salmon fishery was enhanced through installation of regional detention basins that help mitigate peak flows and habitat improvements from streambank revegetation projects. Previously, this salmon fishery was limited and unhealthy because of high peak flows from urban runoff that altered the stream channel and carried pollutants.

- Anadramous fish populations are enhanced because SSWU's flood control system is designed to provide maximum flood protection with minimum impact on fisheries and fish migration. During salmon spawning season, flood control gates remain open until significant heavy rainfall occurs.

- Sensitive areas (floodplains, wetlands, and steep slopes) are protected through the city's Natural Determinants Regulations, which prohibit development of designated areas, including 740 acres of wetlands.

- The city is restoring Phantom and Larsen Lakes in partnership with the Washington Department of Ecology. Restoration measures for Phantom Lake over a two-year period reduced annual internal phosphorus loading to the lake by approximately 75 percent and reduced annual external phosphorus loading by 39 to 54 percent. The trophic status of Phantom Lake improved substantially after implementation of restoration measures, although it remains a eutrophic lake.

- Ecological and aesthetic features of the natural environment are preserved through regulation of new development under city codes and a Comprehensive Plan to reflect the philosophy that development should be integrated naturally with the environment and preserve rather than overcome natural features.

Recreation Activity

- Kelsey Creek, a natural water channel that was developed to convey storm water from the city of Bellevue to Lake Washington, provides recreational opportunities such as canoeing, birdwatching, and hiking.

- Cleanup of Mercer Slough (a 325-acre wetland), along with stream and wildlife

enhancement in Mercer Slough Nature Park, resulted in increased canoeing on the slough and increased visitation to the park's interpretive trail.

- Phantom and Larsen Lakes furnish recreational opportunities such as fishing and educational opportunities for school children, who visit the lakes for environmental education projects.

Economic Activity

- Clean water in Bellevue and the surrounding Puget Sound area is important for drinking, food sources, recreation, and industry.

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